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Index to Volume V

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CONTENTS

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General Oil Refining Practice

Selection of refinery site; boiler plant and pumping requirements, details of distillation and treatment processes for oils, pitches and asphalts; storage; fire protection precautions; railway trackage and wharf requirements.

C. D. Dean, A.M.E.I.C.

Paper presented before Toronto Branch, The Engineering Institute of Canada, October 21st, 1920.

Among all the great mass of technical literature, that devoted to petroleum refining, is very meagre, partly on account of the great complexity in the physical and chemical characteristics of crude oil and the products therefrom. In the past the technologists in the industry have been made from within and the extensions they made to the knowledge of the art were of a confidential nature until comparatively recent times, when the academically trained man with the scientific mind has found a place therein with the result that literature pertaining to petroleum has made its appearance, and no doubt from now on will increase in scope and volume.

The difficulty confronting anyone interested in the art and anxious to get a quantitative as differentiated from a qualitative knowledge of the industry is the preliminary data to which the usual engineering principles can be applied and in this paper by courtesy of Imperial Oil, some — at least — of this data will be given.

Selection of Refinery Site

In the selection of a refinery site, aside from the usual economic consideration such as, markets, transportation, land values, labor and taxation, the primary physical requirement is fresh water in comparatively large quantities for boiler and condensing purposes. Sea-board plants use sea water for condensing purposes if fresh water is scarce or difficult to obtain, but one sea-board plant secures fresh water from a river 22 miles away.

Depending on the method of receiving crude and shipping finished products, as well as the variety of products to be manufactured, it is found that from 10 to 20 acres of land will be required per 1000 barrels of crude capacity daily. To minimize pumping heads, steam and electric power transmission losses, etc. the area should preferably be square and level, but as standard trackage is a necessity not only to handle current car movements, but also as storage for surplus empties, a rectangular area is usually selected—if available.

The total water requirements are usually found to lie between 1,000,000 and 1,500,000 Imperial Gallons per 1000 barrels crude capacity daily, depending on the variety of manufacture, and ordinarily the pumping rate will be found to be quite uniform. For plants located on level ground the combined static and friction heads are rarely over 100 feet and during the past ten year the use of centrifugal pumps for this purpose, operating at speeds of 1500 to 2000 R.P.M., has increased, due to their well-known characteristic of flexibility.

Aside from the requirements for mechanical power and heating, a great amount of steam is required for distillation and other uses in the process of refining and it is found that the steam requirements in our Canadian climate necessitates a boiler plant of between 500 and 650 H.P. per 1000-35 I.G. barrels crude daily. The load is usually found to vary quite widely and overloads for sustained periods 25 per cent above nominal rating are common. The water tube boiler is now coming into general use, but the nominal rating is figured 50 percent higher than the builders' rating and there is sufficient overload capacity left to take care of the variations encountered in refinery work.

Boiler Plant

Oil refining is a process carried on throughout the 24 hours each day and the boiler plant is the mainstay on which operation depend. The selection of the proper size of units for a boiler plant is sometimes rather difficult, but for refineries of up to 10,000 barrels of crude daily, 300 to 500 H.P. units are used. Above 10,000 barrels per day crude capacity, any large size of unit can be used, but it is generally felt that not more than 15 percent of the boiler capacity should be shut down at a time for repairs or cleaning.

As one-third of the total refinery fuel requirements which if liquid fuel, would vary between 20 and 30 percent of the crude run daily, is consumed in the boiler plant, economizers and super-heaters, the former preferred, are a regular installation and it is pretty generally the present day to install recording thermometers and water and steam meters, as well as CO_2 recorders, etc. in order to check and maintain efficiency and to ascertain correctly steam costs.

In certain locations fuel oil is used as refinery fuel, but it has so many advantages of an economic nature that makes it ideal as a fuel for ships and for heating purposes in cities, especially for offices and for public and private institutions, where transportation or cartage is a considerable item in fuel costs, that an effort is usually made to leave the fuel oil for these purposes. Generally speaking, coal is favoured as a refinery fuel and when it is used in boiler plants, especially in those of 1500 H.P. and up, stokers and power driven coal and ash handling apparatus are used, as in nearly every case they can be economically justified.

It is the general practice to locate the steam plant as near as possible to the centre of the refineries and carry the steam pipes supported on stanchions to the points where steam is used. In many of the processes, exhaust steam is as advantageous as the live steam and a network of exhaust lines, practically duplicating the live steam lines is installed. The steam pressures vary from 100 to 125 pounds gauge, while the exhaust line pressures are usually set at from 6 to 10 pounds gauge with an average of 8 pounds, and standard steel line pipe is used in both cases.

In general, it is found that the uses for exhaust steam are so varied and continuous that no waste from the exhaust lines occurs, and it is a rare thing to see the relief valves on them blowing. The current practice is to cover live steam lines with one inch of 85 percent magnesia, and one inch of hair felt with staggered joints and a final protective covering of roofing felt, while the exhaust lines have only a covering of one inch of 85 percent magnesia with roofing felt protection.

Under these conditions the radiation losses in live steam lines are found to be approximately .248 B.T.U. per hour per square foot of external surface of pipe per degree difference in temperature between the steam and the outside air. The radiation losses from the exhaust lines are found to be approximately .463 B.T.U. per hour per square foot of external surface of pipe per degree difference in temperature between the steam and the outside air. Taking the average boiler load, throughout the year it is found that the actual heat losses, from both live and exhaust lines, rarely exceed 5 percent of the generated steam.

The prices of coal have risen so much, compared with the prices of insulating materials, that a double jacket on exhaust lines would probably be financially justified. In designing live steam lines, the effort is made to keep the pressure drop for lines supplying large units of power to not more than 5 pounds.

Power Requirements

The requirements for mechanical power for pumping and other purposes, up to a few years ago, were all provided for directly by steam apparatus. In pumping, the duplex steam pump was used, while the throttling and occasionally the automatic cut off steam engine was depended on for the general mechanical purposes, incident to the business. For some time a controversy raged, as to whether or not there was a loss in using power apparatus, which required large quantities of live steam when the exhaust could be used so conveniently in the process.

It has been found by more refined investigation that the losses incident to the blowing of exhaust lines have been practically eliminated by the use of more efficient steam using apparatus and besides a real saving in boiler fuel for the same refining capacity has resulted from the same cause, seemingly altogether due to the more efficient use of the heat units absorbed in the prime movers.

The substitution of the centrifugal pump for the old style steam pump has had the largest effect in determining the modern trend for mechanical power in oil refining work. It is the nearest approach to a duplex steam pump for reliability in refining operations where liquids of a viscosity comparable with water are to be handled and its use has introduced the electric motor. Profuse lighting is a necessity for oil refineries and with the advent of the electric motor, an electric power plant became standard apparatus in a well ordered layout.

It is usually found for lighting and all mechanical purposes, except pumping high viscosity oils, the electric power consumption for a plant on level ground will be approximately 1000 K.W. hours per 1000 barrels of crude run. For plants built on sloping ground where comparatively high static pumping heads are encountered, it will be found that the electric power consumption will vary between 1500 and 1750 K.W. hours per 1000 barrels of crude run.

It is generally found that the maximum peak at the switch-board will be not more than 2-1½ times the 24 hour average, and the demand factor, figuring input to motors and watts per lamp, ranges around 40 percent, but this latter figure must be accepted with reservations for obvious reasons. As far as the peak load ratio is concerned, intermittent services like loading and discharging steamers are not included because as they usually occur throughout a 24 hour period continuously, they simply add their input rating to the refinery peak. While it is true the refinery process is continous, it is found that the peaks occur between 7 a.m. and 6 p.m.

The power characteristics usually selected are 440 volt, 3 phase, 60 cycles or 25 cycles-depending to some extent on the type of prime mover, and 440 volt apparatus was chosen primarily, because of the opinion that prevailed that this voltage would be safer for the operators, although the writer believes doubts on this points are confessed. The lighting voltage is all 120 and in the case of a small refinery is stepped down at the switch-board to save transformer costs. For large tramsmissions and comparatively large powers, where economically justified 2200 volts with step-up transformers are used and latterly for certain purposes 2200 volt apparatus is coming into use, although it is considered in its experimental stage, as far as oil refining work is concerned. Motor drives throughout are either the constant speed or variable speed induction motor, the latter being a rarity as it is only used to drive plunger displacement pumps.

The power factor at the switch-board is found to be between .8 and .9 although on occasions the writers has seen certain plants go as low as .7, but it will be found that if the water pumps are carefully calculated and the oil pumps are designed to take the worst case, as far as head conditions are concerned, the motors will run close enough to full load to give good power fadtor, especially if the generator capacity is flexible enough to have as near full load operation as possible. The transmission lines give a line loss of from 5 to 8 percent and trunk lines are generally liberally figured, because of the certainty of adding additional apparatus from time to time.

The type of prime mover used to drive the generators, is either steam engines or turbines oil engines of the full Diesel or semi-diesel type and gas engines. The steam engine is favored for units up to 200 H.P. each, while for larger units than this the direct connected turbine or the belted oil engine is chosen with preference for the former unless the advantages of the latter are overwhelmingly in its favour.

The gas engine driven units are not adopted unless the plant is located contiguous to a large field yielding natural gas or unless the refinery produces large quantities of by-product gas and only then when fuel is high, giving the gas a high comparative value. As a rule the oil and gas engines are not flexible and cannot respond to overload without distress, and the manufacturers usually recommend that they be operated on continuous loads of 80 percent or less than their rating.

Crude Oil Reception

Crude oil in quantities is received by tank car, by pipe line and by tank ship, or any combination of these methods. The most favoured means are by tank car or tank ship, because these means are independent of any field. As a rule, oil producing is a hazardous game and a pipe line usually requires a comparatively large capital expenditure. For short distances to the sea-board, a pipe line is preferred to tank cars, if the field warrants, while for long distances over land, the decision for pipe is a matter of considerable moment, and requires the exercise of judgment, based on long experience in the vagaries of oil production.

When crude is received by pipe line the tankage for receiving it is usually in two units of sufficient capacity to hold a full week of pumping to guard against possible shut-downs of the line which frequently occur, enough to warrant the expenditure for this safe-guard. The two units are necessary to gauge receipts properly.

When receipts occur by tank cars, provision must be made for interruptions in railway service, as well as for the vagaries of train movements and transfers, so that it is customary to carry about one week's supply, although it is not unusual for the tank car situation itself to dictate the amount of storage necessary for crude because of fluctuations and peaks in the movement of finished products at certain periods of the year. When crude is received by tank ship the capacity of the largest ship, plus about 15 days supply must be provided for due to the hazards of navigation and the difficulty of adhering to a pre-arranged schedule.

In the case of crude receipts by tank cars, pumps must be provided for unloading and these are usually made large enough to permit unloading and the re-dispatch of the empties within the standard 8 or 10 hours day or between switchings if two per day can be arranged. While it may seem like an economic waste to dispatch cars empty, the fact is cars in crude service must be cleaned to carry refined oils and besides the cost of cleaning and the time lost to do this, is the uncertainty of load in the direction of the crude supply. Tank ships are equipped with steam pumps for discharging their cargoes, but the rate of discharge which should be high to minimize avoidable demurrage, is influenced by two factors; the capacity of the ship's boilers and the allowable pressure on the hose connecting the ship to the permanent lines on the dock. If the lines to the crude tankage are long or if the static head ashore is comparatively high, shore booster pumps are used of large enough capacity to accommodate the rate of discharge of the largest ship.

First Distillation

The first distillation of crude oil occurs in crude stills, which are operated either continously in a battery or batch singly. Sometimes a combination of methods is used but the effort always is to get the most out of the crudes without using too much apparatus and the whole operaton depends on the characteristics of the crudes - no two of which are alike.

In the first distillation the separations that are made are naphtha distillate, refined oil distillate, gas oil, lubricating distillate and fuel oil, as well as coke if distillation is carried to dryness. These distillates are usually run to gravities which have a range of boiling points, in which considerable latitude is necessary but the aim is to approximate a degree of separation that reduces the necessity for subsequent distillation.

The continuous method lends itself to an exchange of heat between the ingoing charge and the distilled vapour, as well as the residual bottoms and thereby gives an opportunity for fuel saving, but it is only used when running for fuel oil or in refining parlance topping, because it does not give good separation. In running for fuel oil, the aim is to prevent cracking and while distillation occurs at what is called "atmospheric pressure" the temperature rises and reaches the critical temperature for certain fractions. To eliminate this tendency in distillation, the temperature are reduced by introducing dry steam, which owes its efficacy to the law of partial pressures, but which, as before mentioned, cause the fractions to overlap.

To get the most from crude in the sense of securing all the products with characteristics that are the most useful in industry, it seems to be necessary to distil to coke and do whatever cracking will naturally occur with a given crude at atmospheric distillation, which in reality is about ½ pound gauge.

In skimming operation alone it is ordinarily found that from 8 to 35 cubic feet of fixed gas, under standard conditions, is produced per barrel of crude run, while in coking from 50 to 120 cubic feet of fixed gas is produced, and it is found that a relation exists between the gas and coke produced. There is a distilling loss which probably averages for paraffine base crudes around 5 percent, but for asphaltic crudes goes as high as 15 percent. As far as they will apply, considering the uncertain element from cracking, the specific heat of oil on the pound degree Fahrenheit basis is ½ B.T.U., while the latent heat ranges between 140 and 150 B.T.U. per pound for atmospheric distillation.

An effort is made to secure as good fractionation as possible in the first distillation by using reflux towers through which air circulates and knocks down the heavier fractions in the vapour stream. In designing these towers they are made as flexible as possible by some system of control of the air circulation and for certain crudes and certain rates of running, it is sometimes necessary to jacket the towers, at least, in part.

The modern still of 1000 barrels charging capacity, has two towers and 3 worms or condensing coils, or 3 towers and 4 worms and the design of worms is made altogether on the basis of a low rate of heat transference, about 1000 B.T.U. per square foot of surface per hour, so as to provide great flexibility. Ordinarily the stills run either a 2 day or 3 day schedule, depending on the characteristics of the crude. The condensing water used is altogether based on the heat to be extracted from the oil and the rate of distillation, and for oils that have no viscosity the temperature is allowed to go as high as 120 to 140° F.

For such oils as have viscosity at ordinary temperatures, as would retard flow in the worms and thereby increase the time schedule the practice is to cool these to a temperature that gives them low viscosity and this is done by taking the condenser water at 120 or 140° F. from the light worms and using it to cool the contents of the heavier worms.

It will be appreciated that distilling to coke means very high temperature and the flue gases reach as high as 2000° F. towards the end of the run. As a general thing, the temperature of operations are all very high and as a result the labour needed to affect current repairs is as great as that needed in the operations. All still equipment is designed to permit the making of repairs as cheaply as possible by arranging the fire sheets and brick work so as to minimize the amount of tearing down in order to affect the real repairs. For the same reason the worms are built of cast iron flanged pipe installed so that any section can be removed and replaced without disturbing the other parts.

The draw-offs from the towers are arranged so that they can be sent back to the stills or on through the worm to the receiving-house and the run-backs to the stills are equipped with traps. Each worm runs to a look-box or turret in the receiving-house and the manifolds delivering to the receiving tanks are ordinarily placed in the ground floor of the buildings.

The gas is taken from the discharge end of the worms by a suction of about 2-½ inches of water, so as not to lift off any light vapours.

Treatment of Distillates

The finishing of the distillates is done by treating to remove unsaturated compounds, which give odor and color, etc. and subsequently distilling, but the order in which these are done depends on the product. In general, it may be said that treating is the first process in naphthas and refined oils and the last process in lubricating oils, but this is not necessarily so.

The treating of naphtha distillates is done either continuously or batch, and consists in bringing the distillate into intimate contact with commercial sulphuric acid of 66° Be. and after the re-actions have proceeded allow the sludge to settle out. The oil is then washed with water to remove all traces of the acid that can be removed by this means, then settled again, after which it is treated with caustic soda or soda ash to neutralize the acid that still remains. The sludge is again settled out after which the oil is washed with water. In general, it is found that the quantity of water required in treating is equal to about 35 I.G. per barrel, while the quantities of acid vary between ½ and 12 pounds per barrel, and the quantity of soda solution is approximately 12 gallons per barrel. There is always a loss in treating, varying between ½ and 3 percent.

From the treating plant the naphtha distillate is ready for finishing and is charged constinuously to a steam still, where the gasoline is extracted by fractionation leaving a bottom or residue that is largely kerosene.

Steam stills, since they run continuously, are equipped with vapour heat exchangers, oil heat exchangers, oil coolers, water separators, etc., and in addition have over the still a large tower, where the ingoing charge trickles over stones through which the out-going vapours pass. The object of the tower is to knock down any kerosene

fractions that may be leaving the still with the gasoline. The heating medium free, live or exhaust steam, is introduced into the still beneath the oil surface and it owes its efficacy to the operation of the law of partial pressures, previously mentioned. The pressure in the still is not allowed to exceed about ½ pound gauge, if possible, but on occasions it may, and the still is, therefore, usually built with spherical head's or is otherwise braced. These stills are built usually of 1200 or 1500 barrels batch capacity and the running rate depends on the condensing surface in the worms which is, therefore, made ample. It is found that approximately 8 pounds of steam is required per gallon of gasoline or roughly 1 pound steam per pound of gasoline overhead and the charge is fed at the rate of about 60 to 75 barrels per hour per still, requiring about 450 to 550 boiler horse power depending on the percentage taken overhead. On the condenser end of the vapour line means is provided for expanding the vapours before they enter the worm so as to take out any condensed steam and at the outlet end of the worm a trap is provided that takes out the most of the water from the interior of the worm and discharges it to a sewer. It may be mentioned here that for this and all other stills, about a two inch thickness of magnesia blocks and a weather protection is used to minimize radiation losses.

The treating of refined oil distillate is similar to that for naphthas, except that this is always batch in a loose top cone bottom agitator. The reason for this is that the oil has some viscosity and it is difficult to get an intimate mix of the chemicals and oil without violent agitation. This agitation is secured either by blowing with air or by circulating through a pump. Blowing with air means large losses; circulation with a pump means longer time and therefore large investment, but at the present time, both systems are in use. If, however, the oil contains large quantities of sulphur, blowing must be resorted to in order to get efficient chemical action.

After treatment and neutralization, the kerosene distillate is charged continuously to a battery of rerun stills which are, as in the case of crude stills, of about 1000 barrels capacity each, using bottom steam. With these stills use is made of vapour heat exchangers and towers, as well as oil heat exchangers and coolers for the residual bottoms. The condensation in the vapour heat exchanger and the tower is removed through separate cooling coils, while the vapours passing the tower are conducted into a worm. From these stills is taken a gasoline cut and refined oil as well as what is known as a re-run cut for re-treatment and re-distillation and the bottoms go to fuel oil.

There are many specifications for gasoline and refined oil, but in operating in the refinery the former is run for boiling points, while the latter is run for flash and viscosity which in a measure are imperfectly related.

The lubricating distillate contains the waxes or at least most of them, and before it is ready for finishing and treating, this wax must be removed. Present day practice involves the cooling by refrigeration of the whole distillate to between 32° F. and 0° F. and forcing the distillate under about 1000 pounds per square inch through filter presses where the wax crystallizes out and allows the oil to drip through. In cooling the distillate, it is fed through chilling machines, which are a series of long pipes, in which screw conveyors work to prevent the wax from adhering, and around which the brine is circulated. It requires a press for every 200 to 250 barrels of distillate and about 25 tons of refrigeration per press. After the press is full of wax, the filter plates are loosened and the slack wax drops into a hopper with a conveyor in the bottom, where it is broken up into small blocks and discharged into rundown tanks. In the rundown tanks the wax is melted and heated to quite a high temperature when it is pumped to the wax sweaters.

Slack Wax

The slack wax contains about 50 percent of its volume as oil, which must be removed before the wax is ready for treating and finishing in commercial articles. Wax sweaters consist of two sets each, consisting of a series, usually 12 to 24 shallow pans, one above the other carried on a frame work and enclosed within a brick or concrete building. The building has no windows, but both ends are almost completely doors, and the roof has ample adjustable ventilating openings, while the sidewalls are covered with steam coils.

In each pan is installed a closed coil on top of which is a screen of about ¼ inch mesh, although coarse sand is sometimes used. Each pan is filled with cold water up to the screen, and on top of this is pumped the hot slack wax, after which cold water is circulated through the coils if necessary to cool and solidify the wax. After the wax has become solid enough the water is run from each pan to the sewers and the doors and ventilators are shut, after which the steam is turned on in the building which heats the air up and allows the wax to soften sufficiently to allow the entrained oil to filter through to a pipe line that carries it to the pressed oil tank where the oil, which escaped from the presses when the wax was being pressed out, is stored preparatory to being transferred for further treatment. After the oil has been sweated out, steam is turned on in the coils within the pans which melts the wax and allows it to run down a separate line into what is known as a rundown tank building, which is plentifully supplied with steam coils. From this building the wax is fed to the wax treating plant, where it is filtered through Florida clay to eliminate the colouring matter and is then sent to the candle works where it is moulded into candles and other shapes for consumption.

The oil from the wax presses is delivered to the reducing department, where it is distilled in reducing stills either continuously or batch. These stills are never run down to coke and all the overhead distillates are closely fractionated into the various grades of lubricating stocks. The oils all carry considerable viscosity and they are allowed to issue quite warm from the ends of the worms, from 125° F. on up, depending on the viscosity. The bottom is the very high viscosity oils which at temperatures little below boiling temperature would flow very sluggishly, and it is termed a botton product. As cracking, which destroys viscosity, is to be eliminated great quantities of steam are used, about one pound for each pound of oil overhead, which must be disposed of and in order not to make it necessary to install too large a worm the steam is withdrawn from the worm after the oil has become liquid by a light suction induced by a jet of water. When the stills run continuously, an effort in made to converse

heat by creating a suction through an exchanger, where the steam gives up some of its heat to the ingoing charge.

The lubricating distillates, including the bottoms, are transferred to the treating plant where they are treated to remove objectionable matters of various kinds which are due to the insaturated compounds.

The treating is done in agitators which are equipped with closed coils running up and down adjoining the interior of the shell vertically. After charging, the steam is turned on and the batch is heated up to reduce viscosity and the acid dumped in successive doses, while the whole is agitated violently for some hours by an excess of air. The acid heat and the heat from the coils serves to allow the sludge to settle out, when it is drawn from the cone bottom of the agitator into either an acid coke pit or cooking kettle.

The treatment of lubricating oils some times necessitates as much as 50 pounds of acid per barrel of oil and there is a great deal of sulphuric acid left in the sludge and in a sludge coke pit; this is allowed to fester and drop out a coke, which can readily be handled and burned. With a cooking kettle, however, live steam is turned in the mass which separates the uncombined acid and the coke and this uncombined acid is pumped to the acid restoring plant and the coke, which is much less in amount in this case, can be handled and burned.

The treated oil in the agitator is now transferred to a wash tank, which is about double the capacity of the agitator, and which is jacketed and equipped with both open and closed steam coils. Here the oil is thoroughly washed with hot water about 180° F. and as the oil has been heavily treated, larger quantities must be used. After treating and washing the oil is neutralized with a soda solution and again washed with large quantities of hot water. The batch is then left in the wash tank and is maintained at a high temperature by the steam coils to permit the water to settle to the bottom. After all the water has settled out that can be eliminated in this way, the oil is transferred to a bleacher which is a tank, contained within a building, and in which is a large steam coil as well as air blowing coils. In the bleacher the oils are blown bright, i.e. the moisture is all eliminared, and are then transferred to the stock tanks, either for shipment or for filtering through clay to remove soapy substances that attract moisture and that in certain services would be deleterious.

Pitches and Paving Asphalts

One of the modern developments in the art of refining, which is growing enormously, is the production of pitches and paving asphalts from asphaltic base crudes, which in America come from California, Texas or Mexico.

This distillation is conducted batch in 1000 barrel stills, the condensers of which have large worm capacity. For certain crudes comparatively low in asphalt or pitch content, the stills are equipped with one or more towers for fractionation, but when the asphalt content is comparatively high these are notused. Mexican crude is the only one that the writer knows of that is used in Canada for the production of asphalts.

The various light oils come over successively, and depending on their boiling points comparatively close fractionation can be arranged in the tail house on the basis of gravities. The present practice is to produce asphalts as a bottom product, that is they are not driven overhead, on account of the high temperature necessary to do this. The steam serves the purpose of preventing the rise of temperature and thereby prevents the cracking of the bottoms, and asphalts can be produced that will have a minimum of carbon content. The steam is drawn from the worms beyond the point where the oil has condensed and is condensed with a water jet in a sealed chamber from which the still gas escaping with the steam is pulled by exhausters and burned beneath the stills. In order to cheapen the cost of operation, insofar as the use of bottom steam is concerned, some California refineries use vacuum stills operating at from 24 to 26 inches of vacum, and in addition introduce small quantities of steam which if properly distributed facilitates circulation and thereby prevents local heating.

High melting asphalts are produced by blowing air through the bottom, as it lies in the still and a slow fire is maintained beneath. It is claimed that the effect of the air is to oxidize some of the hydrogen in the chemical structure of the pitches producing the higher in the series with consequent raising of the melting point and other physical characteristics that go with this. It may be mentioned that about 500 cubic feet of free air is required per minute per still for oxidizing purposes.

Distillation under Pressure

In the early days of petroleum refining the effort was made to produce all the refined oil, fuel and lubricating stocks that the crude would yield and waste the light fractions, now in such great demand, and a good crude was considered to be one in which the percentage of fractions lighter than those permissible in refined oil was low. The development of the motor car, truck and tractor has radically changed the situation and crude oils are now valued, very largely on the basis of their gasoline and lubricating oil content. It was quite natural to expect that with a knowledge of the fact that crude oil can be cracked at atmospheric pressures in a coking still, an effort would be made to see what advantage would lie with distillation under pressure. Several patents in this direction were secured very early when the demand for gasoline showed evidence of exceeding the supply, and there are a few that are being commercially used on a large scale by big refineries in the United States and Canada. There is an immeasurable host of patents of this kind appearing every month, but they are mostly mechanical deviations from the existing apparatus and depend for success on the same principles on which all are based.

The first principle is that oils suffer a redistribution of molecular structure when raised to their critical temperatures and the heavier fractions have critical temperatures lower than those for the lighter fractions.

The second principle is that as pressure is made use of to get higher temperatures it is necessary to produce a fixed gas as well as condensible vapours in the still in order to hold pressure.

Probably the most successful apparatus in use is that covered by the Burton patents now owned by the Standard Oil Co. (of Indiana) and licensed to various companies in the United States and Canada. The stills use a gas or fuel oil of 30 to 35 gravity, as charging stock

which contains comparatively heavy fractions, having little or no lubricating properties and which would ordinarily reach the market as fuel oils. They are charged batch and run semi-continuously at about 96 pounds gauge pressure and have a capacity varying between one and two hundred barrels each per day. Approximately 50 percent of 50 gravity distillate is taken off ovehead and the bottoms are about 22 to 26 gravity. There is a loss of about 3-½ percent in operating which is nearly all gas. These stills sometimes have quite complicated overhead fractionating equipment to knock down for recracking the heavier vapors, as there is a rise in still temperature occurs of about 100° F. during a run as the gravity of the bottom increases.

The fuel consumption is about 1-8 of the charge if liquid fuel and the fixed gas produced is around seventy-five cubic feet under standard conditions per barrel charged. The still temperatures vary from about 640° to 740° F. and the flue temperatures are around 1200° F. The latest practice is to install steam superheaters in the flues to supply superheated steam to the various continuous and reducing stills using bottom steam.

The distillate is treated either continuously or batch, similar to the method of finishing crude naphtha and is then distilled continously either in fire stills or steam stills and yields gasoline, refined oil and a residual bottom which is gas oil.

The general refinery production of still gas, which will average probably about a hundred thousand feet per 1000 barrels per day, is usually burned in the refinery although instances in the United States are not rare where it is sold to gas companies direct as enrichment for water gas, etc. In refineries a very elaborate system of exhausters and gas lines is installed to dispose of it and when the production is large with wide fluctuations in the rates of production, as sometimes occurs, gasometers are used to prevent loss.

The still gas is usually found to have a heating value from 1000 B.T.U.'s per cubic foot to as high as 1800 B.T.U's per cubic foot, depending on the amount of gasoline vapour carried. Modern practice now calls for absorbers to extract the vapours from the gas which is usually done by forcing the gas after cooling, under low pressure through towers in which a menstruum of gas oil or any other similar heavy oil, the inital boiling point of which is considerably higher than the final boiling point of the absorbed naphtha can be,—is trickling. It is ordinarily found that the menstruum will absorb about 10 to 11 per cent of its volume as naphtha and a gas that will yield one Imperial gallon per 1000 cubic feet is considered to pay for the extraction. The menstruum with entrapped naphtha is steam stilled under about 15 pound gauge pressure and the recovered naphtha, after treatment, is mixed with the current production of naphtha. On steam stilling, it is found that a loss of about 5 percent of the volume of the menstruum occurs, i.e. this amount goes overhead with the naphtha.

Storage

Practically everything including waxes and asphalts—but of course not coke—is stored in tankage and handled by pumping. The tankage is all steel and varies in size from 5′ diameter by 10′ high, having a capacity of 35 barrels to 120′ diameter by 40′ high, having a capacity of 80,000 barrels.

The tanks are designed for a stress of 20,000 pounds per square inch on the net area of the shell, when full of water, but no plate in the shell or bottom is less than ¼ inch thick. Generally speaking the bottom is made of 3-8 inch steel and the roof plates of 3-16 inch material. The roof is designed to carry a wind and snow of 30 pounds per square foot and while the practice of a few years ago was to install truss roofs quite extensively, the present practice is to use I beam supports, bolted at one end and free to slide on the other to take care of tank distortion, due to settlement of the foundation or varying elongation of the materials with differing oil heights.

Tanks varying in capacity from 20,000 barrels to 80, 000 barrels weigh about 9 pounds per barrel, while for tanks from 10,000 barrels to 20,000 barrels the weight of steel per barrel is about 10-¼ pounds and for tanks from 5,000 to 10,000 barrels the weight is about 12-½ pounds per barrel.

The space occupied per tank is quite variable, but very roughly follows the plan of allowing one square foot of ground per barrel capacity. The deviations from this rule are frequent however, depending on the shape of the tank lot and local regulations, if there are any. As far as possible, for light products ,i.e. gasoline, refined oil, fuel oil and crude, the tanks are surrounded by dykes - built high enough to hold the contents of the tank should disaster occur, but there is a rule restricting the height of the dykes to 6 feet, and it is adhered to quite religiously on account of the need for accessibility for hose reels, etc.

For certain heavy products, such as heavy crude oils, fuel oils, lubricating oils, waxes and asphalts, the tanks are equipped with very elaborate heating coils, the surface of which is designed on the basis of the highest expected pumping rate, and in addition, certain lubricating tanks and all wax and asphalt tanks are jacketed with four inch hollow tile jackets to conserve heat and assist in maintaining high temperature. Every tank is equipped with two or more water draw-offs, in the shell near the bottom, which are arranged so as to remain full of oil after the water has been withdrawn from the tank. In tanks 25′ in diameter and larger, two manholes are provided, one on the roof and one on the shell near the bottom.

The oil lines are connected through the shell either at the top or the bottom. The top connection is favoured by some people, as line breakage does not involve the loss of the contents. It does, however, mean a continuous maximum pumping head and the bottom connection on this account is generally used. To safe-guard as much as possible against loss from line breakage, the line inside the tank is on a swing either by using a specially constructed valve or by using two ells so that the entrance of the pipe can be raised above the oil level.

The oil lines are all screwed steel pipe and are made large enough to give a total head for a refinery on level ground of from 65 to 75 ft., i.e. when centrifugal pumps are used, but for asphalts, waxes, etc. the pumping heads vary, although initial starting pressures greater than 100 lbs. per square inch are not favoured. In general for all important inter-refinery process pumping, no line is made less than 6″. Process pumps, motor driven, are either centrifugal driven by constant speed motors, or triplex single or double acting, or some of the patented positive displacement pumps driven by variable speed motors.

In pump-houses, which are located in carefully selected locations and are as few in number as possible, the pumps and motors are separated by brick walls as an additional protection against fire. For certain purposes, such as pumping waxes and asphalts, etc., no motor driven apparatus can be used, because the power required at starting is several times that required after the volume of oil in the line gets moving, and it is usual to put in a high ratio duplex steam pump for this work, as the exhaust steam need not be wasted.

Fire Protection

Fire protection is an important consideration in an oil refinery and large expenditures are made to provide fire fighting facilities on an elaborate scale. All tanks are equipped with 2″ steam fire lines, which enter in two places on a diameter near the top and which during thunder storms are opened. If steam enters a tank and displaces the air, the risk of fire is nil, but after an explosion if the roof blows off, and it nearly always does, steam is comparatively useless. During the past five years a new system of fighting oil fires has been developed known as chemical foam and there are three commercial foam formulas in use now.

The foams are mixed right at the tank in a mixing chamber either within or without and when discharged on the surface of burning oil, act as a blanket. The protection required per tank is difficult to estimate and is usually based on judgment. A conservative figure is that about three feet of foam per tank will be needed which is equivalent to about three gallons of solutions per square foot.

Current practice does not call for the installation of foam storage, totalling the whole risk, and it is customary to aprovide storage for, roughly, 10 percent of the tank risk. The foam making solutions are kept in separate tanks until required. In all the foam making formulas, the acid solution consists principally of 10-½ to 12 percent by weight of aluminum sulphate and 85-½ to 89 percent of water. The soda solution consists of about 8 percent of sodium bicarbonate and 89 to 91-½ percent of water. These produce the carbon dioxide and the other ingredients to produce the bubble for containing the gas, differ.

In the first one glue, glucose and arsenous oxide is added to the soda solution. In the second foam powdered extract of licorice is added to the acid solution, while in the third foamite is added to the soda solution. The first two are not used much for new installations, as the bubble materials deteriorates rapidly. In all cases, the expansion by mixing is about eight to one when fresh solutions are used, but ordinarily refinery storage solutions will give an increase of about 6½ to 1.

To cover a refinery risk means quite an extensive network of lines, as well as powerful pumping equipment, and it may be noted that foam hydrants are located at strategic points to permit the use of foam an other risks besides tanks.

Probably the most expensive fire fighting apparatus consists of the usual water protection. This consists of the well known hub and spigot pipe which in refinery work is all class "C" and powerful pumping equipment with boosters wherever necessary. It is the aim to provide for at least 12 standard 2½ inch hose at the farthest point in the fire lines. The use of water in oil fires is simply to keep surrounding apparatus and tanks, buildings, etc. cool during the progress of a fire to prevent insofar as this means will, the widening of the fire area.

Railway Trackage and Wharf Facilities

The amount of trackage required at a refinery varies considerably and depends on the percentage of the crude and finished products that will be moved by rail, as well as the amount of tank car storage space desired for seasonal variations in the movement of finished products. A rough figure of trackage requirements is about a half mile per 1000 barrels of crude daily, but for plants located on water it will be very much less than this.

Tank cars for use in the transportation of oil are built in accordance with the American Railway Association's specifications for carrying inflammable liquids, whose vapour pressure does not exceed 10 gauge at 100° F. If however casinghead naphtha is to be moved, Class IV tank cars must be used.

Wharfage facilities for plants erected on navigable waters, are, as far as possible, pile structures with deep water face, approximately 400 feet long and arranged for a boat draft of 20 feet in fresh waters and 30 feet at low tide in sea waters.

The deck loading is figured at about 400 pounds per square foot. For certain sea locations, particularly in South America loading and discharge of steamers is done through undersea lines, which sometimes are laid a mile out before sufficient depth of water for boat draft is reached. The end of the pipe line is either a hose supported on an anchored float or a small deck protected by pile dolphins. Such lines have a life of about four years.

Repair Shop Equipment

As mentioned previously, a very large part of the expense of refinery operation is due to the excessive repair work necessitated by the severe punishment that distilling and treating apparatus receives in service. On this account, mechanical shops, having carpenter, machine, boiler, blacksmith and pipe departments are a regular installation.

The customary equipment for the carpenter shop is a bandsaw and planer, and for pattern work a wood lathe is useful. The machine shop equipment preferably consists of two lathes, a planer, two drills, a tool grinder and bolt cutter, as well as the miscellaneous small tools, incidental to a well equipped machine shop. In the boiler shop, plate rolls to handle plates up to 16 feet wide are used, although some situations can be cared for by 12′ rolls. In addition, a power operated punch with at least a 36″ throat and fitted with a shearing device is a necessity, as well as a full complement of air drills, hammers, etc. The blacksmith shop should have a steam hammer, as well as the usual hand forges, etc. The pipe shop should be equipped with two pipe machines, one to cut and thread pipe from ½″ to 4″ and one to handle up to 16″ O.D. pipe, and in addition, the usual complement of hand tools for cutting and threading up to 4″ pipe should be available for use outside the shop.

Tank cars require regular repairs, and these together with the repairs incident to refining necessitate a storehouse of ample capacity, fully stocked with standard hardware and equipment specialties, as well as brick, lime, cement etc.

It is rather difficult in a paper of this kind to cover matters in as great detail as perhaps the importance of the subject justifies and in case any one is further interested in petroleum refining and wishes to rend an authentic publication, no better selection can be made at the present time than Bacon and Hamor's American Petroleum Industry.

The Place of the Laboratory in Standardization.

Types of engineering standards: measurement, constants, quality, performance, practice; work of the laboratory in determining standards, methods employed by the laboratories of the Hydro-Electric Power Commission of Ontario

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Standardization has been the subject of so much discussion during the past few years that an apology is an almost necessary introduction to a paper on this subject. Yet it is the hope of the writer that a description of the part played by a large operating organization in the preparation of standards of engineering and in their application to its work, may be of interest to *The Engineering Institute.* The part of the Hydro-Electric Power Commission of Ontario in this work, as will be brought out, lies chiefly in the application of these standards; their preparation is the co-operative work of many organizations- industrial, operating and regulating- in which work the Commission shares. The discussion approaches the subject from the point of view of the laboratory. An attempt will be made to establish the thesis that the laboratory is of fundamental importance in the preparation of engineering standards. Such examples as given are taken from the work of the Laboratories of the Hydro-Electric Power Commission.

In its broadest sense a standard is a model, example or authority with which comparison may be made. The application of a standard thus implies measurement and the value of standards in engineering is directly proportional to the degree to which they reduce comparison to quantitative measurement.

The standards of engineering may be grouped into five main classes:

1. Standards of measurement
2. Standard constants
3. Standards of quality
4. Standards of performance
5. Standards of practice.

Standards of measurement form the basis of all scientific and industrial research and of commercial intercourse. They are based upon arbitrary choice and include both fundamental and derived standards for expressing quantitatively the relations of space, time, energy, matter and motion. Among standard of measurement are included the units of length, mass, heat, light and electricity.

General View of High Tension Laboratory.

Standard constants are the numerical expressions of the fixed properties of matter or of the relations between the various forms of energy and matter and between physical quantities, the value of which it is necessary or useful to know. These are also of fundamental importance to science and industry and include such quantities as the mechanical equivalent of heat, viscosities, boiling and melting points, electrical conductivities of materials, etc.

Standards of quality usually take the form of specifications of the desired properties of a material in terms which

admit of measurement. The purpose of such standards is to provide a guide for the manufacturer in the production of material and thus to secure a high quality in the products of industry; and to serve as a scientific basis for purchasing by enabling the purchaser to specify the desired qualities of the material in definite terms and to make the necessary tests to determine its quality.

Standards of performance are specifications which may be applied to machines, instruments, or devices as standards of quality are applied to materials. To be of value they should specify the factors involved in terms susceptible of measurement. Specifications for electric generators, motors, transformers, weighing devices, steam engines, are standards of performance. To determine the performance of a machine requires the application of standards of measurement and standards of quality.

Standards of practice are the expression of scientific or technical requirements in the form of rules or laws. They involve such matters as the safety of property or persons, the relations between different corporations or between corporations and the public. Building codes and standards of electrical construction are examples of this class of standard.

Of the five classes of standards discussed above, the first, standards of measurement, includes those standards which are fundamental to science and industry, but which are purely arbitrary. The second class, standard constants, embraces fixed quantitative relations expressed in terms of standards of measurement. The preparation of these standards does not come within the province of an operating organization but is the function of national standardizing laboratories and scientific research workers. Certain standards of measurement are, however, maintained by most operating organizations; these may be called secondary or working standards as contrasted with the primary standards maintained by the national laboratories. The Hydro-Electric Power Commission maintains standards of electrical measurement and of photometry in the form of precision resistances, standard cells and incandescent lamps. These are instruments of high quality which have been compared with the fundamental standards of resistance, current and candle power maintained by the Bureau of Standards of the United States, and their characteristic properties determined to a high degree of accuracy. They are used to maintain the accuracy of the laboratory measuring instruments, and thus form the basis of all the work of the laboratory and of the standardization work of the Commission.

The determination of standard constants is also without the province of our laboratories.

The standards with which the operating organizations such as the Hydro Electric Power Commission are chiefly concerned are those of quality, performance and practice. The Laboratories are engaged in co-operation with other departments of the Commission in the preparation of such standards and in their application to the work of the Commission.

The preparation of standards of any kind involves a clear understanding of the requirements of the service to which the standard may be applied. These requirements must be stated in terms susceptible of measurement. A standard of engineering involves such questions as the properties of materials, the efficiency of apparatus, the safety of property or persons and the legal rights of corporations and individuals.

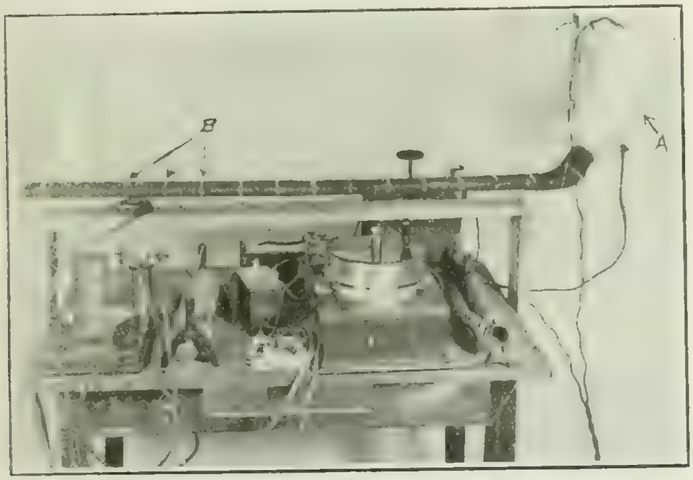
Short Circuit Test on 13,000 Volt Fuses.

The purpose of a specification may be defeated by setting the standard too low or too high. Too low a standard will cause waste and poor efficiency; too high a standard may have the same results. A careful study of the economics of each case should be made before setting a standard of quality, performance or practice. For example, in the design of a transmission system, the insulation of the transmission line should be so related to the insulation of the terminal apparatus that safety will be obtained at the minimum of cost. Too low a value of flashover voltage would result in frequent interruptions and line repairs; on the other hand, too high a value would increase the cost of the line and would impose an additional hazard on the system in that it would transfer the burden of defence against the attacks of excess voltage and of destructive surges of the terminal equipment, the failure of which would be more serious than in insulator failure and more difficult and costly to repair. As a further example, consider the specification of the efficiency of a transformer or of its exciting current. An increase in efficiency or a decrease in exciting current will increase the cost. It must be determined by the purchaser how much he can afford to pay for these improvements. In other words, he must balance the saving in cable, bus bars, switches, etc, resulting from the higher standards against the additional cost of the higher standards.

The preparation of standards of engineering, especially those of quality, performance and practice, can be satisfactory accomplished only by co-operation among the interested parties. The preparation of standards of practice is usually the work of governmental bodies who prepare the standards in co-operation with those organizations interested in and affected by the regulations; the standards are then promulgated as rules or codes. Standards of quality and performance are the peculiar interest of engineering and operating organizations. The work of preparing such standards has heretofore devolved largely upon the professional engineering bodies. In the United States there is also an organization whose exclusive function is the preparation of Standards, the American

Society for Testing Materials. The work of standardization has received a great impetus recently in the formation of national engineering standards associations. The co-operation of these national bodies has in reality formed an international standardizing association, the importance of which will grow rapidly and have an enormous influence on future engineering pratice in all countries.

The Hydro Electric Power Commission is represented on committees of the various standardizing organizations and the Laboratories are co-operating in the investigational work of these committees.



Thermal Conductivity of Generator Armature Coil.
A—Source of heat (a coil of wire carrying current).
B—Resistance coils wound over insulation to determine temperature at various points.
Thermal conductivity calculated from readings.

Standards of Quality

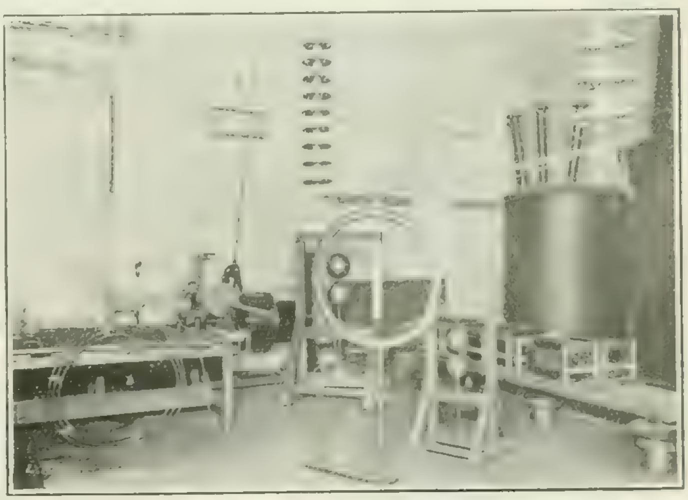
The need for standards arises whenever it is desired to purchase material intelligently, to effect economies in the construction of large works, or to operate such efficiently. The beginning of any standard is in the laboratory because it is almost always necessary to know the properties of a material before a standard of quality or even of performance and practice can be prepared, and a knowledge of the properties ofmaterials can only be obtained by investigation. The preparation of a standard is a process of evolution; let us take for example a standard of quality - insulating varnishes for electrical work. The desired properties are first determined. The varnish must resist the passage of electricity, that is, it must possess dielectric strength. It must have elasticity and flexibility under the temperature conditions to which it will be subjected. It must be moisture-resisting, oil-proof; and must not contain acid which would be injurious to the conductor or material to which the varnish is applied. These qualities are all necessary, but in order that a standard may be definite the properties must be stated in terms which admit of measurement. The first attempt at comparing varnishes under specification would probably be an estimate of the relative standing of the several samples submitted, with respect to these desired qualities. As experience was obtained in the use of the varnishes it would be possible to set suitable values for dielectric strength, oil proofness etc. and a definite standard would finally be evolved.

The work of the Laboratories respecting standards of quality covers practically the entire field of engineering materials. When standards exist the task of comparing any number of materials or of determining the quality of a single sample submitted is comparatively easy. It involves merely chemical or physical measurement. But for many materials no standards are available and it is then necessary to prepare tentative standards. It is usually possible to make comparison between two or more samples of a material with respect to any desired quality even though definite standards be not available.

The gradual accumulation of data from such tests lays the foundation for definite standards of quality. The work of the Laboratories in this connection has included such materials as transformer oil, tapes and cambric for electrical insulation, insulating varnish and moulded insulating material for electrical purposes, Portland cement, lubricating oils, gasoline, paints, protective coatings, metals for various structural uses, etc. The task of the Laboratories in the preparation of standards for such materials is twofold: first, to determine what values to assign to the desired properties; second, to devise methods of test by which the properties may be measured.

Methods of test are fundamental in the application of specifications and may have an important effect upon the value of the results of any comparison between competitive materials. In developing methods of testing it is also necessary, in many cases to devise testing instruments and apparatus; the results obtained often depend to a great extent upon the testing apparatus employed. An example will serve to illustrate this point.

The dielectric strength of insulating material such as oil or thin sheet insulation is determined by applying



High Frequency Test on Transformer Coil.

voltage to the material placed between electrodes. The values of breakdown voltage depend upon the shape of the electrodes and their size, as well as upon the time of

application of the voltage; it is then necessary that the required dielectric strength be specified in relation to the apparatus used to determine it. In the case of transformer oil three different devices have been developed to determine dielectric strength and confusion often arises in the interpretation of results when the method of test is not stated. The device used by the Laboratories consists of two discs 1 inch diameter spaced 0.1 inch apart on a horizontal axis. In the case of thin sheet insulation no standards have as yet been universally adopted; for the purpose of comparison the Laboratories has adopted a particular form of electrode and rate of application of voltage.

Standards of Performance

The work in connection with standards of performance is the counterpart with respect to apparatus, of the work in connection with standards of quality. The function of the laboratory is advisory to the engineering, purchasing and operating departments. The greater part of this work consists in efficiency tests on electrical machinery after installation and in tests on incandescent lamps. Assistance has also been given to the engineering and purchasing departments in the preparation of specifications for these classes of apparatus. In the preparation of specifications for high tension transformers, the necessity arose to specify the dielectric strength of the end turns nearest the line side, it being evident that these turns must be more heavily insulated then the interior turns. Such a test must be made at a very high frequency, as it is manifestly impossible to build up sufficient voltage at low frequency across the low impedance of the few turns of the end coil. After considerable investigation an oscillating circuit was built up which supplied sufficient energy at a frequency of approximately 300,000 cycles to accomplish the test and to enable us to set a reasonable value for the required dielectric strength of the end coils of the transformers. Considerable work has also been done in preparing specifications for incandescent lamps. This has included compilation of data regarding lamp performance; investigation of the effect of various operating conditions upon life; economic studies to determine the most suitable efficiencies and life under conditions of power cost in Ontario.

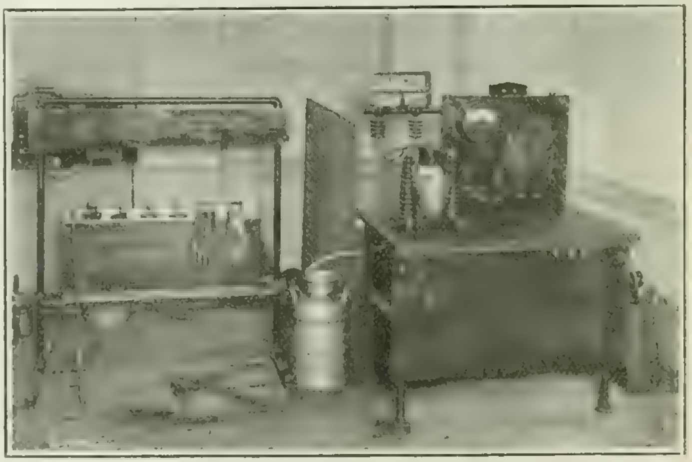
Standards of Practice

The standards of practice with which the Commission is concerned are of two kinds:

1. Standards governing practice in conctruction or operation of its systems.
2. Standards which it is obliged to enforce by reason of legislation

Among the first class are included all standards of construction and of operating routine. Those with which the Laboratories have a certain responsibility are concrete materials and linemen's rubber gloves.

Standard instructions for the handling of concrete materials have been prepared by a committee on which the Laboratories are represented and it is the duty of the Laboratories to act in an advisory capacity to the engineering and construction departments in carrying out these instructions. These instructions provided for the selection of suitable sources of materials for any concrete construction job; this is the duty of the Laboratories. From tests on these materials at the Laboratories the proportioning to yield the desired strength of concrete is determined. On jobs of sufficient size to warrant the expense, a field laboratory is installed and a continuous check upon the quality of concrete is maintained. The proportioning is varied as rendered necessary by changes in the quality of the materials; test samples are taken periodically from the mixer, stored for 28 days and tested for compression. In this way it is possible to determine whether the desired strength in the concrete structure is being obtained. Considerable research work has been conducted by the Laboratories in connection with methods of proportioning and a method has been evolved and tried out on several large jobs which renders possible important economies in the use of cement. The results of these researches have been given in several publications in the technical press. These articles have also been printed by the Commission and are available to those interested. The value of the standard of practice just described is not confined to economy in the use of cement. It furnishes the designing engineers with knowledge of the strength of the structure. Without this knowledge they would be forced to a more conservative design calling for higher strength in many cases than necessary.

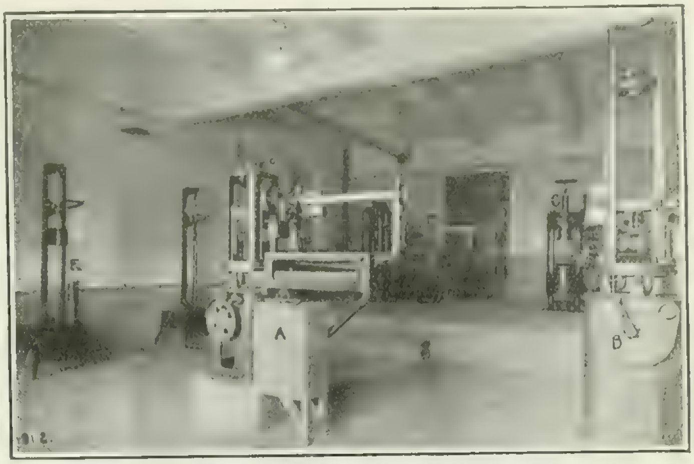


60,000 Volt Test Set for Testing Transformer Oil, Rubber Gloves, etc.

The standard for rubber gloves and its application is the function of the accident prevention department. All gloves are purchased under strict specifications as to plysical and electrical properties and stored in the Laboratories. Before being sent out to the field each glove is given a dielectric test of 10,000 volts and all good gloves are sealed in special envelopes indicating that the gloves have been tested. Each month all gloves are returned to the Laboratories for re-test. They are given a minute inspection for mechanical defects and a dielectric test of 10,000 volts. Every percaution is thus taken to insure againts accident to employees working on live lines. In connection with the preparation of this standard many tests have been made on the physical properties of the material entering into the gloves and methods of test have been developed to determine these properties.

The second class of standards of practice relates to the enforcement of the proviions of the Electrical Inspection Act. There are two distinct standards, one relating to the installation of wiring and electrical equipment in or upon buildings, the other to the design and construction of electrical material, devices and fittings for use in such installations. The first standard thus has to do with methods of installation, the second with the quality of the material or devices installed. The application of this latter standard is the function of the Laboratories.

The law requires that all electrical material, devices and fittings for use as specified in the preceding paragraph be approved by the Commission before being offered for sale or used in the province of Ontario. The object of this regulation is to eliminate as far as possible, fire and accident hazard from electrical apparatus and appliances, and thus protect the public from loss or danger incident to the use of electricity by reason of defective construction The work of the Laboratories consists in testing and inspecting all such material, devices and fittings, and in maintaining lists of approved material. A routine procedure has been adopted under which manufacturers submit samples of their product to the Laboratories where they are examined and tested in accordance with standardized methods as set forth in the specifications. When a device has been found to agree with the specifications it is formally approved by the Commission and may be so marked by the manufacturer. The Commission issues a list of approved devices and conducts an inspection service in order to be assured that approved devices are kept continously up to standard by the manufacturers. The preparation of specifications for the test and construction of electrical material, devices and fittings is a necessary part of this work, which is carried on in co-operation with the electrical inspection department of the Commission, the electrical contractors, manufacturers and jobbers, and the fire underwriters.



Testing machines in Structural Laboratory.

Many standards are in use by the Commission which are not mentioned in this paper. As indicated in the introduction the aim has been to describe the place of the laboratory in the work of standardization and such examples as are given were chosen with this aim in view. Standards to be of value must be continuously revised to keep pace with advances in industry. This implies improvements in methods of test and in testing instruments as well as revision of the requirements of use, and this in turn, implies investigation. The principal contribution of the laboratory to the work of standardization is the substitution of exact knowledge for judgment, which latter even when experienced can be but a poor substitute for the former. It would thus appear that the laboratory has an important place in the work of standardization.

The Aeroplane Engine

The requirements of aircraft propulsion and their effect on engine design.

P. E. Biggar, S. E. I. C.

Paper presented before the Montreal Branch, The Engineering Institute of Canada, November 3rd, 1921.

Man has always been keenly attracted by the air. Throughout the ages, he has been willing to risk, and too often sacrifice, his life in his efforts to explore this alluring element. He speaks of the lowly mortal as "of the earth, earthy" and depicts the heavenly being as an angel with wings. Even the sophisticated man of to-day feels this spell and cannot resist the temptation to gaze at the chance aeroplane overhead.

Probably this attraction is principally due to the very invisibility of the air. The intangible always possesses a psychological fascination. Then, there is the possibility of attaining very high speeds which already exceed those reached by any other mode of transportation. In flight, one leaves behind the restrictions of the earth and may travel by the shortest route and manoeuvre in three dimensions.

For many centuries, the conquest of the air remained but a dream. Nature's great barrier to flight, gravitation, proved insurmountable, until the wonderful development of the internal combustion engine, in the hands of Daimler, Benz and others, made available a power plant which would, in some measures at least, fulfil the exacting requirements of aerial use.

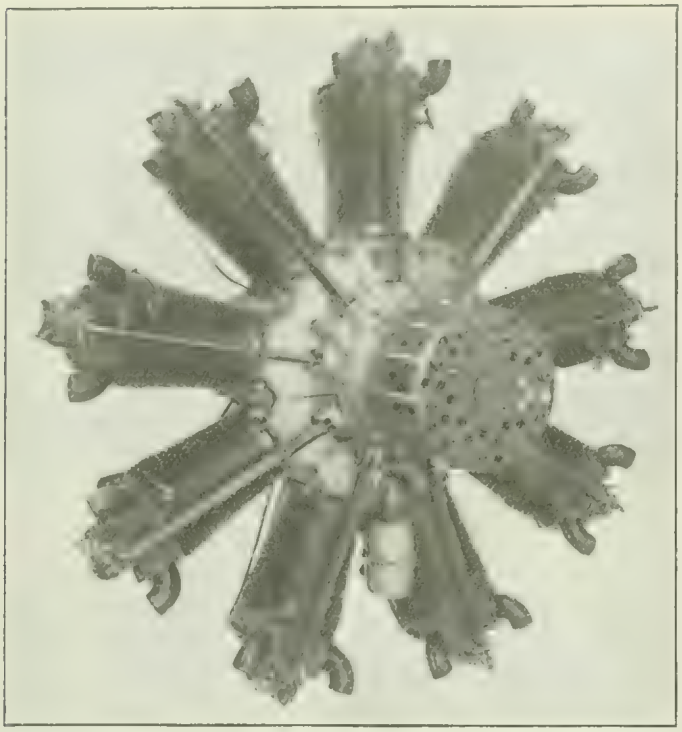


Fig. 1 The 450 H.P. Bristol "Jupiter".

Flight, like all man's greatest achievements, depended upon the evolution of a suitable prime mover. The standard of performance is so high and the conditions of operation so severe, that the aero engine will always be the finest of mechanisms. The only motor which has proved suitable for use in the air is the internal combustion engine of the four cycle, low-compression type, which is so widely known through its use for automotive propulsion.

The Requirements of the Aero Engine

Let us consider the factors which have governed the development of the aero engine. The following may be said to be the specifications of an engine suitable for use in the air, in order of their importance.

(1) The aero engine must be reliable.

(2) It must be as light as possible.

(3) It must be economical in its consumption of fuel and oil.

(4) Its head resistance, when installed in the plane, must be as low as possible.

(5) It must have a satisfactory degree of uniformity of torque and freedom from vibration.

(6) For use in war, it should be concentrated.

(7) For commercial use, it should be low in first cost and durable in service.

Reliability.

The first factor, reliability, is of very great importance. Apart from financial considerations, the whole future of commercial aviation depends upon the degree to which engine failure can be eliminated. In land or water transportation, a failure of the motive power will result in a delay of a few hours at most, but with flying, the plane, no longer able to keep to the air, must glide to a landing. The passengers will be delayed indefinitely and, if the plane is forced down over unsuitable country, run the risk of personal injury.

Reliability is of even greater importance to fighting craft. The efficiency of a squadron is measured by the number of hours of useful flying carried out per machine per day. Planes which are unfit to take the air demand the attention of the mechanics, night and day, until they are made serviceable and, during moving warfare, must often be abandoned, just when their potential value is greatest. Should the engine fail when over the lines, the pilot is unable to carry out his duties and becomes an added responsibility to his companions.

How, then, is reliability to be ensured? Firstly, the materials must be carefully chosen. During the war, great advances were made in the quality and treatment of the steels used in aero engines and 100 ton steel is now employed for the more highly stressed parts. Then the design must be worked out with great care. Success is only attained by a nice blending of the science of accurate calculation and the art of wide experience. To meet the requirements of use in the air, the stresses and load factors are somewhat higher than those used in stationary engine design and good judgement is necessary in deciding limiting values. Troublesome parts are duplicated, as far as possible. When the engine is completed, it is given a very severe running test on the bench, is then dissembled and inspected and any faulty parts are replaced.

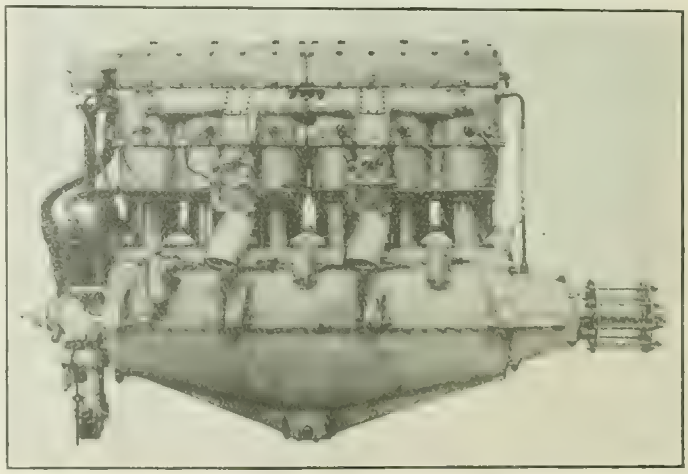


Fig. 2 The 240 H. P. Siddeley "Puma"

This care is wasted if the engine is carelessly handled in service. Before each flight the engine must be gradually warmed up, by running it quite slowly. The pilot must see that the oil pressure and the gasoline supply pressure are maintained at the correct point and, when the cooling water has reached the normal temperature, the throttle is gradually opened until the full rate of revolution is indicated. The condition of the engine is judged from the feel of the compression, when it is cranked over, by the sound of the exhaust and by the rate at which it is able to drive the propeller.

The mechanic is largely responsible for the service of his engine. Each night, the spark plugs must be cleaned and adjusted, the distributors wiped off and all gasoline and oil filters carefully cleaned. The entire engine is inspected for any indication of incipient trouble. After about one hundred flying hours, a stationary engine is given a "top overhaul". The cylinders are removed, the carbon cleaned out, the valves ground into place and all parts inspected. After about two hundred hours, the engine is removed from the plane and given a complete overhaul. In the case of a rotary engine, the top overhaul is carried out after thirty-five and seventy hours and the complete overhaul after one hundred hours flying.

Engine Weight.

The effect of engine weight on the load which the plane can carry is fairly obvious. Every pound added to the powerplant is just one pound less 'available lift'. The weight of the engine reacts on the strength of the bearers and internal bracing needed to carry it in the fuselage and on the extent of plane area and external bracing necessary to take it into the air. An aeroplane fitted with a heavy engine thus presents what the political economist would call a "vicious circle".

This was the great difficulty of the early aviators. Their flights were not of sufficient duration to demand a very high degree of reliability, but it was essential that the engine should develop sufficient power to lift itself and some hundreds of pounds of aeroplane off the ground. This factor was the dominating one in all the early engines. Langley was anxious to try an internal combustion engine in his "Aerodrome" and, as no manufacturer would undertake to produce a model of the extremely low weight required, he designed and built his own. It had five steel cylinders arranged radially about a common crankcase and developed 52 brakehorse power, for a dry weight of only 115 pounds. This type of engine received a great deal of attention during the later stages of the war. Fig 1 shows the Bristol "Jupiter", one of the finest radials of to-day.

The engine used by the Wright brothers was of the four cylinder vertical type. Though quite heavy, it developed but 24 horsepower. In response to a demand for greater power outputs, the six cylinder vertical was produced. Fig. 2 shows the Armstrong-Siddeley "Puma" which was designed during the war. Later on, in order to permit the development of more power without unduly increasing the length of the engine, the V, or diagonal type was evolved and has been brought to a high degree of refinement. Fig. 4 shows the Rolls-Royce "Eagle VIII", so well known for its wonderful performance in the trans-Atlantic and London-Australia flights. Of recent years, the number of banks of cylinders has been increased to three and even four. Fig. 5 shows the Napier "Lion", an extremely successful twelve cylinder engine. Fig. 7 shows the Napier "Cub" which was built for the Air Ministry. Full particulars are not available, but this engine is stated to have developed 1057 B.H.P. in its sixteen cylinders.

A few years after the first flight, the Gnôme rotary engine made its appearance. In this type, the crankshaft is held stationary and the cylinders, which are arranged radially, revolve en masse. In spite of its rather startling design, the engine showed a remarkable weight efficiency and enabled planes to fly which had never been able to lift their heavy powerplants from the ground. As the centrifugal stresses are somewhat severe, the entire engine is usually constructed of forged steel. Fig. 8 shows one of the more recent developments of this type.

The weight efficiencies of some of the engines in use to-day are given in table I. It is interesting to note that the weight of stationary engines varies from about 150 to 500 Lbs./B.H.P., though 30 Lbs./B.H.P. is attained in special types, such as submarine Diesels.

Table I.

Make and Model	Number of Cylinders	B.H.P.	Type	Bore and Stroke Inches.	Weight Lbs/B.H.P.	Fuel and Oil Lbs/BHP/Hour
Beardmore	6	160	Vertical	5.7 x 6.9	4.0	0.55
Bentley BR-2	9	220	Rotary	5.5 x 7.1	2.25	0.70
Bayern or B.M.W.	6	185	Vertical	5.9 x 7.1	3.15	0.46
Bristol "Jupiter"	9	450	Radial	5.7 x 7.5	1.74	0.61
Clerget BF	9	130	Rotary	4.7 x 6.7	2.70	1.00
Fiat A-14	12	700	V	6.7 x 8.2	2.30	0.53
Hispano-Suiza "Viper"	8	180	V	4.7 x 5.2	2.34	0.52
Hispano-Suiza H-2	8	300	V	5.5 x 5.9	2.00	0.54
Liberty	12	400	V	5.0 x 7.0	2.67	0.57
Maybach	6	260	Vertical	6.5 x 7.1	3.10	0.51
Napier "Lion"	12	450	Bd. Arrow	5.5 x 5.1	1.98	0.51
Napier "Cub"	16	1050	X	(?)	2.01	(?)
Rolls-Royce "Eagle VIII"	12	360	V	4.5 x 6.5	2.5	0.52
Siddeley "Puma" or B.H.P	6	240	Vertical	5.7 x 7.5	2.65	0.55

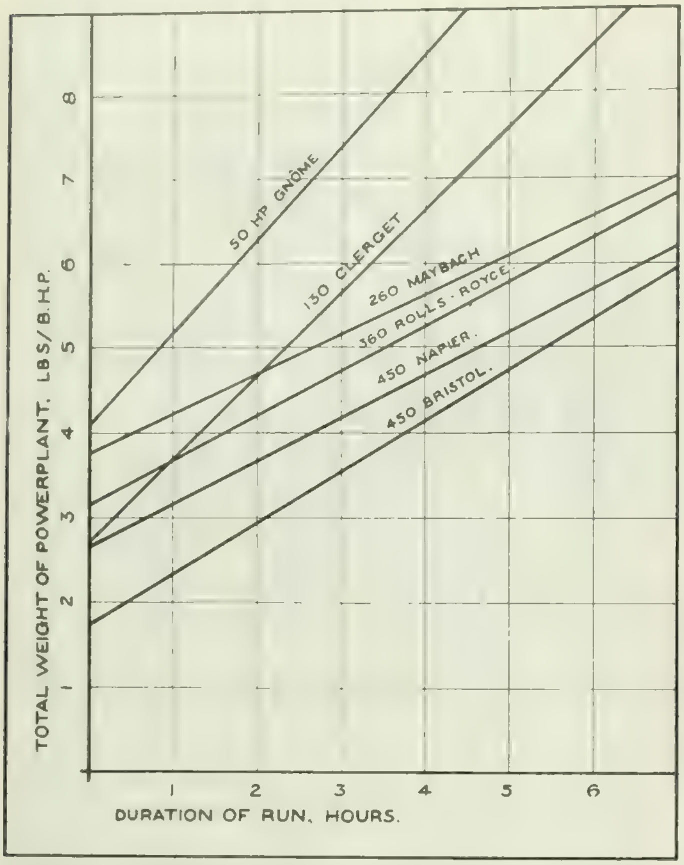


Fig. 3 The Relation of Fuel Consumption to Total Weight.

Consumption of Fuel and Oil.

The factor of fuel consumption is very closely related to that of weight efficiency. It is useless to produce an engine of low dry weight, if, by an abnormal consumption of fuel and oil, the total weight when ready for a few hours run may be bettered by a heavier but more economical rival. Fig. 3 will show this point. The starting point of the curve for any particular engine is determined by its dry weight in lbs./B.H.P. and the slope by its fuel consumption in lbs./B.H.P./hour. It appears that, for a flight of two hours or more, it would be better to use any of the stationary engines shown than to use the 130 H.P. Clerget rotary. In the case of the Napier "Lion", the fuel and oil for a run of six hours will weigh more than the entire powerplant.

With the airship, of which the only promise of commercial utility lies in its ability to remain in the air for long periods and to carry out extended cruises, the factor of fuel consumption is of even greater importance. Considering the case of the 260 H.P. Maybach, which was used in the Zeppelins and in the ill-fated British "ZR-2", we have the following figures,

Weight of powerplant in running order, less fuel and oil	1102.0 lbs.
Weight of fuel per hour	139.0 lbs.
Weight of oil per hour	12.36 lbs.
Weight of fuel and oil per hour	151.36 lbs.

The fuel and oil for a flight of fifty hours, such as a voyage from London to New York, would thus be 7568 lbs., or nearly seven times the weight of the powerplant. This would be modified by the degree to which the engines could be run throttled down, but the figures will serve to bring out the great extent to which total weight is governed by fuel consumption.

Fuel is a costly item of expense. Figures based on the operation of aerial routes in Europe show that the fuel bill constitutes from 29% to 54% of the total cost of operation, depending on the type of machine. American figures show as much as 28% for this item. In the operation of bombing planes, it was usual to place a calculated amount of fuel in the tanks and to use the remainder of the lift for bombs. On the way over, the planes requires careful protection, but, on the return journey, with bombs and half the fuel gone, the bombing machines could easily take care of themselves and, in fact, had an unpleasant custom of leaving their fighting escort far behind, to settle with the Huns.

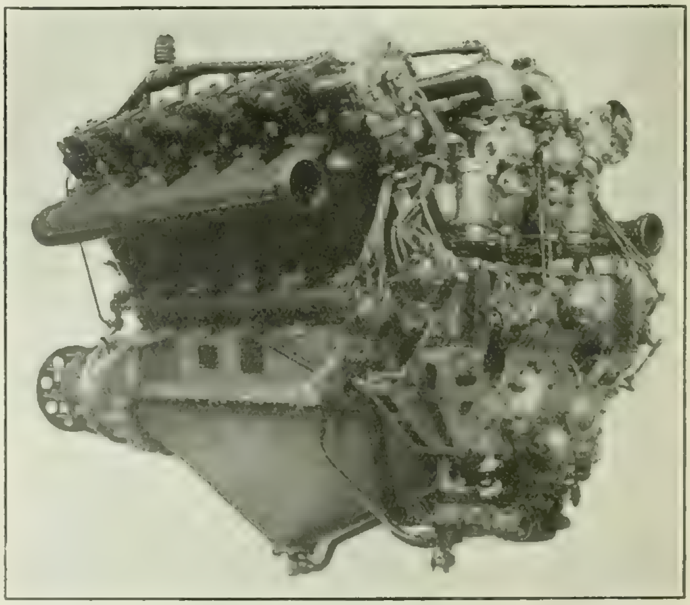


Fig. 4 The 360 H. P. Rolls-Royce "Eagle VIII".

The effort to economize fuel gains added importance from the ever increasing inadequacy of the supply of crude oil. We are forced to seek a more economical use of the gasoline of to-day and to consider a less attractive use of the indigestible fuels of to-morrow. Because of its high thermal efficiency and its ability to burn the heavier oils, the Diesel may yet be used in the air. It would settle our difficulties of carburetion, distribution and ignition, though at the expense of a rather delicate fuel injection system, and the fire risk would be almost eliminated. Experimental engines have been built, but their weight is rather greater that that of the low compression type.

Head Resistance

Since the engine is never left exposed to the air, this factor is really measured by the limitations it imposes

upon the shape of the nose of the fuselage. To this must be added a charge for the "drag" of those parts which are allowed to project from the cowling. In all the latest racing machines and many of the fighting craft, the fuselage is of a very efficient "streamline" shape and the tops of the cylinders are allowed to project a few inches. Some types of engine lend themselves very readily to this treatment. All the water-cooled stationaries may be cowled in very neatly, though their radiators offer a very noticeable resistance to the air. The rotary requires an almost flat nose about four feet in diameter and the radial must have all its cylinders exposed to the air, for effective cooling.

The engine must nearly always be mounted so that it is directly in the path of the air blown back by the propeller and this slip-stream has a velocity somewhat in excess of the air speed of the plane. When we consider that the power required to lift the plane varies almost directly as the speed, while that required to overcome inactive resistances varies nearly with the cube of the speed, one realizes the necessity of keeping this "drag" as small as possible.

Torque and Balance.

The factors of torque and balance cannot be discussed in exact terms. The range of each encountered in practice is surprisingly great. There has been a distinct tendency to increase the number of cylinders used and this may be ascribed to the difficulty of obtaining a very high power from each cylinder. Mechanical and thermal problems arise which are not easy of solution. The largest cylinders used are those of the Ricardo engine which are 8x11 inches and develop 120 B.H.P. Twenty-four cylinder engines have been designed, but the sixteen cylinder Napier "Cub" is the largest yet produced.

Probably an engine of less than six cylinders suffers to some extent from fluctuations in propeller velocity. Gearing is frequently employed to improve the propeller efficiency without a sacrifice of engine power which would arise from a reduced r.p.m. It is difficult to obtain satisfactory service from gearing, if driven by less than twelve cylinders, owing to fluctuations in torque. Flywheels are very seldom used in aero engines, owing to their weight.

With regard to balance, it may be pointed out that, as the engine and its mounting must be very light in weight, any unbalanced forces will cause an unpleasantly marked vibration. The balance characteristics of most of the stationary types are well known, but it may be mentioned that the four has a resultant secondary force acting in a vertical direction, the eight combines the forces of its banks of cylinders so that the resultant is horizontal and the six and its multiples have no resultant forces. The radials have rather large resultant primary forces, which are easily balanced by counterweights, except in the three cylinder radial. The rotary type has perfect balance.

It should be clearly understood that inherent balance may easily be spoiled by careless assembly. Reciprocating parts are always weighed and matched when the engine is built, but this arrangement may be altered during overhaul. In the case of the rotary, if one ounce is left unbalanced at the cylinder head, a centrifugal force of nearly fifty pounds will be exerted, at normal revolutions.

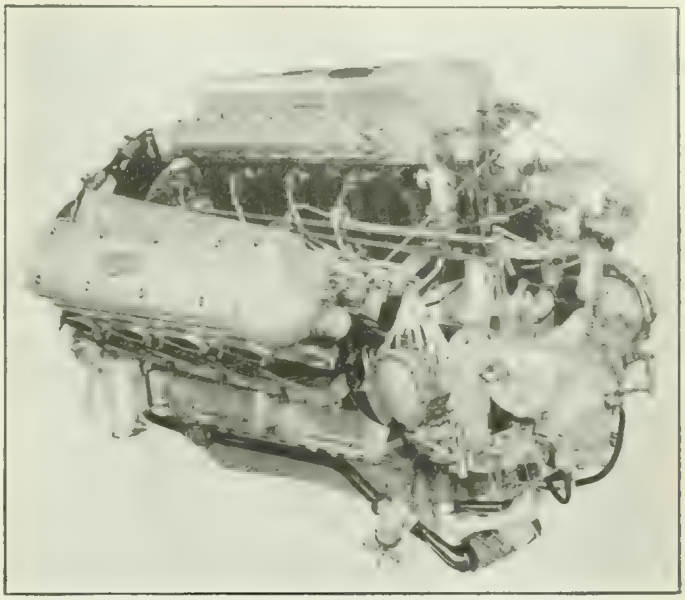


Fig. 5 The 450 H. P. Napier "Lion."

For this reason, the rotating parts should always be balanced on a pair of horizontal knife edges.

Torsional vibration in the crankshaft is often rather difficult to overcome. The Germans met this effect, which we may describe as rotary whipping, by the use of very heavy crankshafts. That of the 260 H.P. Mercedes, for instance, weighs 140 lbs. Even this rather questionable cure seems to have failed in the eight cylinder in line type of Mercedes. In the later British engines, the Lanchester anti-vibrator was used with very good results. Briefly, this consists of a very small flywheel, which is mounted on the end of the crankshaft opposite to the propeller and is driven through a friction clutch. This slips slightly, backwards and forwards, in response to the rotary accelerations of the end of the shaft and exerts a very marked damping effect.

Concentration

The factor of concentration is only of importance for engines used in fighting craft, where rapid manoeuvring is essential. If a rotary or a radial is used, the pilot may be placed immediately in rear of the engine and a very close-coupled arrangement results. The longitudinal moment of inertia is reduced and the machine responds very readily to the controls. This is of great value in a "dog fight" which may best be described as planes flying "madly in all directions". It may perhaps be considered that the gyroscopic effects of the rotary would render it unsuited for this use, but, in practice, these are so slight as to cause no noticeable inconvenience to the pilot.

Cost And Durability

These factors only enter into the commercial use of aircraft, since, in war everything must be sacrificed for effect. By careful design and a slight loss of weight efficiency, the engine may be constructed of cheaper materials and with more durable wearing parts. A commercial engine may weigh as much as 3½ lbs./B.H.P. and

should be able to run for 150 hours between overhauls. Accessibility of design and installation is most important. Inaccessible parts are nearly always neglected and the time of overhaul may be much reduced by careful attention to these details. In one of the latest English machines, the entire powerplant, less the fuel tanks, may be removed by loosening four bolts, after disconnecting the fuel lines and the controls.

Nearly all the current work on aero engines has been the re-designing and improvement of war-time models. In many cases, these were brought out in the shortest possible time with the result that many imperfections were introduced which nothing but the experience of hard service could bring to light. In England, the experimental work has largely been directed towards the development of the maximum power from a given cylinder.

Maximum Development of Power

In considering the possibility of improving the power output of a given engine, let us first examine the theoretical aspects of the case. For the comparison of thermal efficiency in internal combustion engines, there has been set up the "Air Standard". Assuming a perfect engine and that the specific heat of the working fluid is a constant quantity, thermodynamic reasoning will deduce the equation, $E = 1-(\frac{1}{r})^{\frac{C_p}{C_v}-1}$. In the Air Standard, the value of gamma, the ratio of the specific heats, is taken as 1.4 and, using this, we may plot the upper curve in Fig. 6, for practical values of $\frac{1}{r}$, the compression ratio.

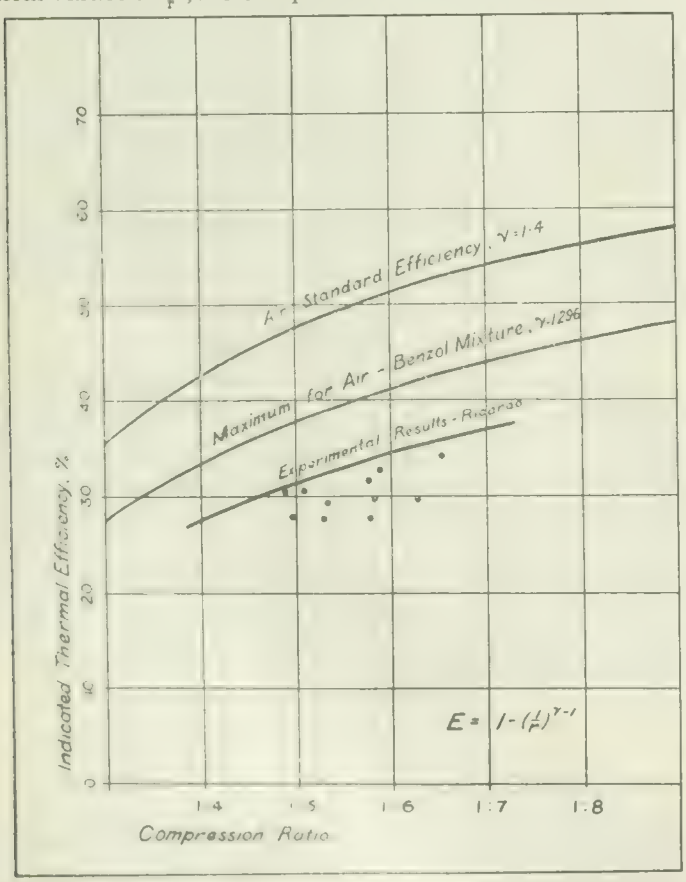


Fig. 6 The Relation of Thermal Efficiency to Compression Ratio.

Specific heat is, however, not a constant quantity. According to Ricardo, the value of gamma for the products of the combustion of a mixture of gasoline or of benzol and air is more correctly 1.296. Using this value in the above equation, we may plot the second curve. The engine is by no means thermodynamically perfect and best practical efficiencies fall lower still. Results obtained by Ricardo in a series of experiments on a variable compression engine are shown in the lower curve. The space between this and the second curve represents the heat losses of the engine. The indicated thermal efficiencies of a number of modern aero engines are indicated by dots. The scope for improvement would appear to be rather small.

High compression is plainly desirable. The possible thermal efficiency becomes greater and the performance at height is improved by the use of high compression ratios. Their great disadvantage is that they invariably bring pre-ignition and fuel knock, more often known as "detonation". This phenomenon has caused a great deal of trouble and, if allowed to persist, is capable of ruining the engine in a few hours. A compression ratio of 4.85 to 1 may be used with gasoline fuel, up to 7.05 to 1 with a fuel of high aromatic content, but, beyond this point, direct injection must be used.

The compression ratio is now frequently carried so high that the engine cannot be run "full out" near the ground. Its performance at height is much improved, but, until this designed height is attained, it must be throttled, or, better still, the closing of the inlet valve so delayed as to shorten the compression stroke. The density of the air has a direct bearing on the mass of the charge inspired during the inlet stroke and, since nearly all war flying is carried out at over 15,000 ft., at which altitude the power is about half that available at ground level, the maintainance of output is an important problem. The present altitude record of about 40,000 ft. was made by a plane equipped with a system of forced induction. Air was supplied to the carbureters by a blower driven by an exhaust turbine and the inlet pressure maintained equal to that of ground level up to about 24,000 ft.

Minimum Loss of Power

Let us now examine the mechanical side of the question. It remains to obtain the maximum efficiency in those points which thermodynamic reasoning assumes to be perfect. Consideration of the familiar "PLAN" formula, indicates that the requirements are as follows,–

(1) The development of maximum brake mean effective pressure which depends on,-

(A) The mean effective pressure and, for a given compression ratio, this is based on,-

(a) Maximum volumetric efficiency. This is a matter of careful design of the inlet tract and accurate valve timing.

(b) Correct and complete ignition, requiring an accurate mixture ratio, especially at full load.-

(c) Minimum heat and pressure losses - quantities which present little scope for improvement.

(B) The reduction of mechanical losses, which is a matter of careful design and effective lubrication.

(2) The attainment of maximum r.p.m., without serious loss of B.M.E.P. This figure reaches 2,100 r.p.m. in modern engines and shows continued improvement.

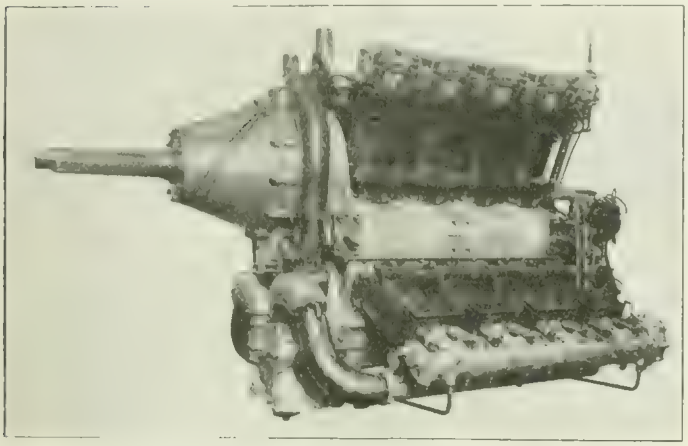


Fig. 7 The 1050 H.P. Napier " Cub ".

The extent of the mechanical losses in a modern aero engine is indicated by the following figures. They refer to the 260 H.P. Mercedes and are expressed in pounds per square inch of piston area.

(a) Piston friction	7.85 lbs./sq.in.
(b) Bearings, valve gear and auxiliaries	2.50 "
(c) Pumping losses	4.50 "
Total losses	14.85 lbs./sq.in.
Brake M.E.P.	107.50 "
Indicated M.E.P.	122.35 lbs./sq.in.
Mechanical efficiency	$107.5 \div 122.35 = 87.9\%$

In the case of the rotary type, it is necessary to add a windage loss of about 15% of the output. This represents the power required to revolve the cylinders against the resistance of the air.

The Development of the Aero Engine.

We have laid down seven requirements which govern the characteristics of an aeroplane engine. We have shown how these have affected its development and have indicated the limitations of present day design. There is one point which the engineer may well bear in mind. During the eighteen years which man has been able to respond to the lure of the air, there has been no change in any fundamental point of aero engine design or operation. The wonderful development of the science of aeronautics is due to careful and unprejudiced attention to the smallest and most insignificant detail. Truly, in the words of the R.F.C. arms, "Per Ardua ad Astra", - "By our Efforts even to the Stars."

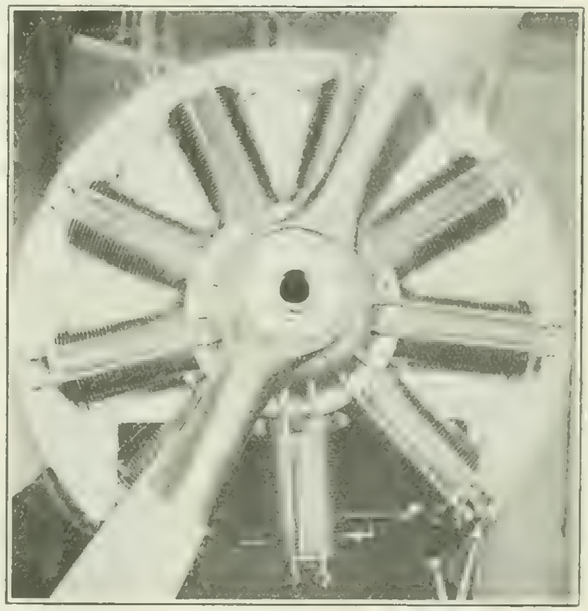


Fig. 8 The 130 H. P. Clerget.

THE

ENGINEERING JOURNAL

THE JOURNAL OF
THE ENGINEERING INSTITUTE
OF CANADA

VOL. V. January 1922 No. 1

Greetings

The President and Council of The Institute for the year just closed, desire to congratulate the members and the Branches on the progress that has been made during the year, particularly noticeable in increased membership and greater Branch activity.

To every member of The Institute the President and Council extend sincere wishes of good will, and express the hope that during the coming year, engineering work will be much more active, and that the members of The Institute will see their dreams realized in greater measure than ever before.

Annual Meeting Announcement

The Annual General Meeting of The Engineering Institute of Canada will be held at Montreal on Tuesday, January 24th, 1922, at ten o'clock A.M., and will be followed by a one day professional meeting under the auspices of the Montreal Branch.

The October *Journal* announcement regarding the Annual Meeting stated that the Annual Professional Meeting would be held in Winnipeg, February 21st, 22nd and 23rd. Owing to representations received, advising that it would be desirable to hold the Annual Professional Meeting at Winnipeg at a later date, the matter was referred to the Winnipeg Branch by the Council, no decision having been reached at the time of going to press for the December issue, the announcement of the business meeting only was included. Following the meeting of Council held on December 20th, it is possible to announce the decision of the Winnipeg Branch that on account of request from Ontario and if for the general welfare their meeting be postponed until September 5th, 6th and 7th, was heartily approved. Owing to the time elapsing between the business meeting and the Winnipeg professional meeting, it was considered by Council advisable, in order to make the meeting at Montreal more attractive, to hold a one day professional meeting, provided the co-operation of the Montreal Branch was secured. The Montreal branch executive, at a meeting held immediately after the Council meeting, unanimously approved of the suggestion that the Montreal Branch should hold a professional meeting in conjunction with the Annual Meeting, on the day following, January 25th.

Although too early to give all details, the members of *The Institute*, coming to Montreal for the Annual Meeting, are assured that they will not only have the opportunity of taking part in the business portion of the Meeting, but that enjoyable social functions will be planned for their entertainment.

Transactions of Other Societies.

It affords considerable satisfaction to be able to announce at this time that definite arrangements have been made with the four Founder Societies of the United States, The American Society of Mechanical Engineers, The American Institute of Mining and Metallurgical Engineers, The American Society of Civil Engineers and The American Institute of Electrical Engineers, whereby members of this Institute have the privelege of receiving the transactions and publications issued by the Founder Societies at the same price as paid by their own members.

The transactions and publications of the Founder Societies may be ordered direct or through the headquarters' office.

Institute Songs

During the past two years a complete change has taken place in the nature of the social functions attendant upon *Institute* meetings. The more or less perfunctory speech is giving way to the Community song, for the better, as all who have attended *Institute* functions of recent years will readily admit.

It has been planned for sometime to issue an *Institute* Song Sheet, and the Secretary has been collecting for that purpose. Suggestions are called for, and any member having any verse relative to engineers, any paraphrase of a popular air directed towards engineering, or any suggestions of songs which he thinks should be included, they will be gratefully received at the Secretary's office. Various college yells will be included, as all Canadian universities are represented in *The Institute* membership. One or two have been received that make light of the work of the engineer and his responsibility, but that is not the kind that it is intended to publish, but rather those of a boosting, inspirational nature.

It is hoped that the members will respond readily to this request, and forward suggestions as soon as convenient. Herewith is reproduced the most recently received suggestion, the key-note of which is along the right line.

I Wanna be in E. I. C.

TUNE: — *I Wanna be in Tennessee.*

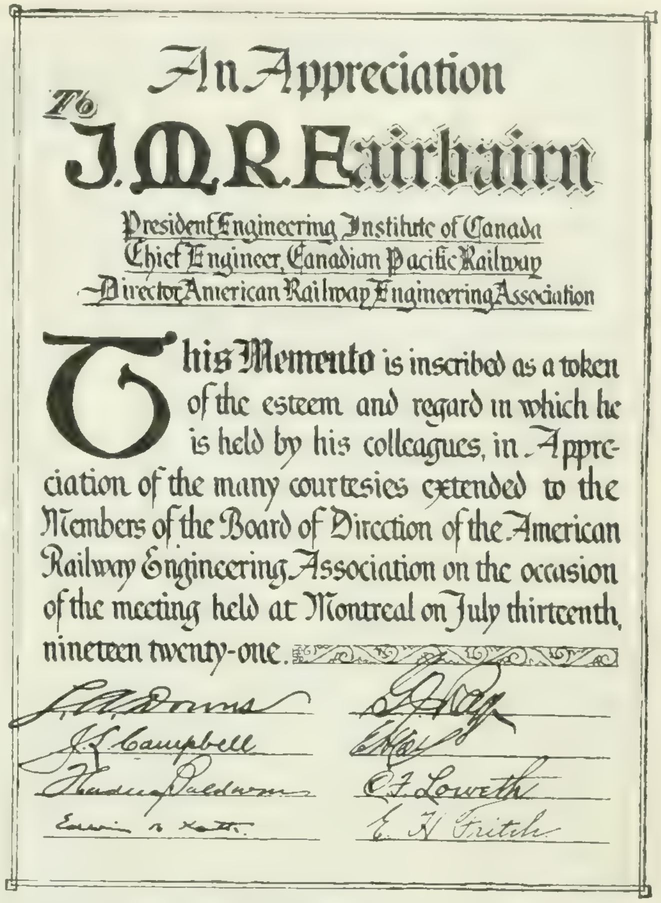
I wanna be in E. I. C.,
Our own Society,
Where the sunny atmosphere
Sends out its radiant cheer
I wanna be where I can see
The engineering feats
Of all the world, upon the lantern sheets
I wanna hear the engineer
Describe with modest mien
And show upon the screen
The things he's done and seen
Come and sing our songs
And forget about our wrongs
And happy be, eternally
In our dear old E. I. C.

Acknowledgment of Courtesies

At a recent meeting in New York of the Board of Direction of the American Railway Engineering Association held at their Headquarters, an event of interest to all members of *The Institute* took place. On the occasion referred to, President J. M. R. Fairbairn was presented by the Board of Direction with a beautifully engrossed memento, fittingly framed, of the Board's meeting at Montreal in July last.

The presentation was made by President L. A. Downs, who gave a brief and pleasing address of appreciation of the courtesies extended by our President and by other members of *The Institute.* Although taken by surprise, Persident Fairbairn made a suitable reply, extending his thanks for the beautiful souvenir of a happy gathering, as he felt the pleasure had been largely his, and that of those associated with him in Montreal. The memento, which was autographed by the members of the Board present at the meeting is reproduced, and will, no doubt, be highly prized by President Fairbairn.

President Downs advised the Board that on behalf of the members of the Board of Direction, he had addressed communications of appreciation for courtesies extended by their Canadian hosts on the occasion of the meeting of the Board at Montreal on July 13th and 14th, including J. M. R. Fairbairn, President of *The Engineering Institute of Canada*; Julian C. Smith, Vice-


An Appreciation

To J. M. R. Fairbairn

President Engineering Institute of Canada
Chief Engineer, Canadian Pacific Railway
Director American Railway Engineering Association

This Memento is inscribed as a token of the esteem and regard in which he is held by his colleagues, in Appreciation of the many courtesies extended to the Members of the Board of Direction of the American Railway Engineering Association on the occasion of the meeting held at Montreal on July thirteenth, nineteen twenty-one.

President Shawinigan Falls Water and Power Company; F. W. Cowie, Chief Secretary of the Montreal Harbour Commission; Fraser S. Keith, Secretary, *Engineering Institute of Canada*, and the management of the Canadian Pacific Railway Company.

Registration — Pro and Con

In view of the prominence which has been given during the past few years to the question of registration for the professional engineer in Canada and the acts already in force in all the Provinces but two, it is of considerable interest to have a light thrown on the situation as it exists in Great Britain. There the movement has not attained the momentum of the Canadian agitation for registration of the professional engineer but more than one of the professional engineering organizations is taking up the matter with some vigour. Whereas in Canada it is generally felt that the title "professional engineer" is sufficiently distinctive in Great Britain the expression is that of "chartered engineer", and parliamentary powers are to be sought to make this title only available to the professional engineer. Opinion is, however, by no means unanimous as to the advantages of this step and following thought provoking editorial from "The Electrician" is worthy of study by the Canadian professional engineer.

The Chartered Electrical Engineer

In the short time that has passed since the granting of a Royal Charter to the Institution of Electrical Engineers, it has become evident how widespread is the gratification at this increase in

status, accompanied as it is by so signal a mark of the Royal favour. This gratification, which is both natural and laudable, exists in spite of the feeling that the possession of such a document can have but a shadowy influence on the average electrical engineer's power of earning his bread and butter, or in assisting the Institution to take its proper place in leading the electrical profession and industry. Nevertheless, it was high time that the Institution should be invested with that prestige which is the prerogative of a State-constituted association as distinguished from a private company, and allowed to take the official position to which its influence and good work entitled it.

But though the charter places a Royal seal on the work and influence of the Institution, after all prestige is a quality which is generated from within rather than from without. If, therefore, the Institution is to be worthy of a Royal Charter, it must be the aim of its members to ensure that its policy and action are worthy of a profession to which it is their pride to belong. In other words although the possession of a Royal Charter confers a well-merited distinction on electrical engineers it requires from them a recognition that their profession has received a promotion which carries with it an additional responsibility. The possession of a Charter is a small thing, unless they continue to make the Institution worthy of the profession and industry it represents.

To discuss the new Institution which the possession of a Royal Charter will bring in its train is, therefore opportune. It will, first, ensure, on paper, that no one may use the title of electrical engineers, unless he or she is a member of the Institution of the Electrical Engineers. It will allow a sharp line of demarcation to be drawn between authorized and unauthorized practitioners, and will place clearly before the public the choice of employing duly qualified men under certain guarantees as regards the knowledge and performance they bring to their work, or of availing themselves of piratical outsiders, accompanied by a certain risk that is by no means off-set by a problematical saving of their pockets. It is true that the public cannot be forced to employ the real or chartered electrical engineers, but it should be the aim of chartered members to see that it is worth their while to do so by a display of individual skill and insight.

If we continue to look at this matter from the public's point of view, however, we find that these sanctions are moral rather than penal. No attempt is to be made to force the public by Act of Parliament or Order in Council to employ only chartered electrical engineers. The attempt could only fail if it were to be made. In this connection the benefits that are conferred by the kind of recognition we are trying to obtain are enormously exaggerated, both as a means of protection and as a method of obtaining wealth and work. To be entitled to the designation "chartered electrical engineer" may, therefore, be little more than a barren honour unless the public can be persuaded to realize that the holder of the title is able to do for them something that cannot be done so well by anyone else, despite protestations to the contrary, of which, incidentally, there will be many, both strident and voluminous.

The lesson the embryonic chartered electrical engineer has to learn is that upon his own exertions alone depend the value of his title, that if to secure that title he imposes upon himself and upon candidates for admission to the profession the necessity of completing a certain course of education and of complying with certain rules, all will be well, and that to be called a chartered electrical engineer will be a mark of honour. That if this is not done and he allows his ranks to be thrown open to all and sundry, the titel, though high-sounding, will be empty and barren of any value.

It is, therefore, essential that the Institution of Electrical Engineers should jealously guard admission to its ranks. Possession of a Royal Charter, the institution of registration for engineers, the laying down of standards of conduct are nothing in themselves. They are, indeed, little more than indications of a policy of purification, which to be successful must be justly and fearlessly carried out. The individual chartered electrical engineer has an equal responsibility in proving to the public, not only that he is competent in his profession, but that he is more competent than the unchartered free-lance man. While, therefore, we view with pleasure the constant growth of the membership of the Institution of Electrical Engineers, we must reiterate the importance of ensuring that such membership is not to be lightly granted.

American Railway Association

An interesting little volume has been published by the American Railway Association relative to the past and present activities of the Association. A copy has been presented to *The Institute* and is available for reference in the Library. The American Railway Association was founded in 1871 and has expanded to a remarkable extent, the membership list including railways in Canada as well as Mexico, Cuba and Japan. On the Board of Directors are a number of Canadians including Howard G. Kelley M.E.I.C., president of the Grand Trunk Railway and E. W. Beatty, president of the Canadian Pacific Railway.

The Association work is conducted by committees dealing with operating, transportation traffic, engineering, freight claims, automatic train control, etc. and the work of these committees is most noteworthy.

Publications of the British Engineering Standards Association

The following specifications and reports have been issued by the British Engineering Standards Association and can be obtained at twenty-five cents per copy from Capt. R.J. Durley M.E.I.C., Secretary, Canadian Engineering Standards Association, Room 112, West Block, Ottawa. A series of translations of a number of the most important specifications and reports issued in French, Italian, Spanish and Portuguese have also been issued by the British Engineering Standards Association and can be obtained from Captain Durley, a revision of the British specification for Portland Cement has also been issued.

Condenser Tubes and Fittings for Marine Condensers;
Creosote for preservation of Timber;
Wood Poles for Telegraph and Telephone Lines;
Terms and definitions for Automatic Telephone Systems;
Benzol for Motor Fuel;
Tungsten Electric Lamps;
Metallic Resistance Meterials for Electrical Purposes;
Switches and Circuit breakers for pressures not exceeding 660 volts;
Tramway Tires;
Soldering Sockets for Electric Cables;
Electrical Pressures for new systems of installations.

Errata

In the letter on "The Metric System" appearing in the December number, the word "Meteorological" should have been "Metrological".

THE ANNUAL GENERAL MEETING

OF THE INSTITUTE
WITH WHICH WILL BE ASSOCIATED A

PROFESSIONAL MEETING

UNDER THE AUSPICES OF THE MONTREAL BRANCH,
WILL BE HELD AT

MONTREAL, JANUARY 24th and 25th

PROGRAMME

(Subject to alteration)

Tuesday,	Jan. 24th,	9.00 a.m.	—	Registration, E.I.C. Headquarters, 176 Mansfield St.
"	"	10.00 a.m.	—	Annual Meeting Called to Order.
"	"	1.00 p.m.	—	Informal Luncheon. (Tickets, $1.00) C.P.R. Windsor Street, Mezzanine Dining Room.
"	"	2.30 p.m.	—	Resumption of Business Meeting and President's Address.
"	"	7.30 p.m.	—	Banquet, followed by Smoking Concert. (Tickets, $5.00) Rose Room, Windsor Hotel.
Wednesday,	Jan. 25th,	9.30 a.m.	-	Visit to Dominion Engineering Works, Rockfield. (Large 41,000 h.p. turbine unit for Shawinigan may be seen under construction)
"	"	1.00 p.m.	—	Luncheon — Rose Room, Windsor Hotel. Members and Ladies. (Tickets, $1.50 — Visiting Members, Complimentary) Followed by short address.
"	"	3.30 p.m.	—	Professional Paper at Headquarters.
"	"	8.15 p.m.	—	" " " "

Accommodation for Visiting Members will be reserved at the Windsor Hotel.

Will you please notify:

J. L. Busfield, Secretary-Treasurer, Montreal Branch, E.I.C.,
260 St. James St., Montreal,

of your requirements and of the functions you expect to attend — or advise your local Secretary.

MONTREAL BRANCH EXTENDS A CORDIAL INVITATION TO ALL MEMBERS

A number of important committee meetings will take place about the same dates.

CORRESPONDENCE

Advertising in the Journal

Dec. 14th, 1921.

Editor, *Journal:*—

Dear Sir:

All members of *The Engineering Institute of Canada* are directly interested in making a success of *The Journal.* Advertising has a great effect on the financial success of *The Journal* and, hence, anything we members can do to encourage firms to advertise therein will greatly benefit *The Institute* and us.

In connection with the work of the Sub-Committee of the Ottawa Branch on Advertising, one firm stated that the money they spent was wasted, as no enquiries or business had come to them as a result of their advertisement in *The Journal.* This may or may not have been the case, as unless those engineers writing to a firm mention that they have seen their advertisement in *The Journal,* the firm has no way of knowing that their ad. has served its purpose to them. Another Ottawa firm has mentioned that its advertisement in *The Journal* has been the most productive of results of any of its magazine or newspaper advertising, this statement being made solely because engineers have mentioned that the firm's advertisement has been noticed in *The Journal* when they are writing for prices or information.

Evidently incidents of this nature are what determine the policy of a company in regard to advertising and it will contribute greatly to the success of *The Journal, The Institute* and ourselves, if every member consistently mentions the fact that they have seen a firm's ad. when they are writing to that firm information or prices. Let's boost our *Journal* in every possible legitimate manner.

Yours faithfully,

J. L. Rannie, A.M.E.I.C.,
Convener of Sub-Committee on Advertising,
Ottawa Branch.

Society of Chemical Industry, Montreal Section

A series of monthly meetings with an agenda of scientific papers and addresses by eminent authorities on the subjects dealt with is being held by the Montreal Section of the Society of Chemical Industry.

Among the interesting features of the session's programme is the joint meeting of the Society with *The Engineering Institute of Canada* and the Canadian Institute of Mining and Metallurgy. This meeting is to be held on January 20 at the Queen's Hotel, preceded by the usual dinner. The papers at this joint meeting will include "Administration of the Explosives Act in Canada," by Lt.-Col. G. Ogilvie, chief inspector of explosives, and "The Electric Steam Generator, its Possibilities and Limitations," by F.T. Kaelin, M.E.I.C., chief engineer of the Shawinigan Water and Power Company.

What is also considered as an important move forward is the formation of an Engineering Group in the Society of Chemical Industry, which will consist of members of sections in Canada and the United States. This group is now being organized and when flourishing will form a valuable meeting ground for the exchange of ideas and discussion of problems where engineering and scientific developments require a closer co-operation.

Since the convention of August last when the Society of Chemical Industry, (which has its headquarters in London, Eng, with Sections in all parts of the world), held its annual meeting in Canada for the first time, and honoured Canada by appointing a Canadian President in the person of Dr. R. F. Ruttan, of McGill University, the members of the Montreal Section have been most active, as the programme for the Session 1921-22 will show.

The first meeting was held on Nov. 18, at which Prof. R. de L. French M.E.I.C. of McGill University, gave a paper dealing with the carbonization of Western Lignite. This address was accompanied by illustrated lantern slides, and Professor French described in detail the efforts that are being exerted to convert this valuable material into economic form. He described the difficulties which had to be overcome owing to the friable nature of this special lignite, and with illustrations showed how these had been surmounted and a carbonized product, suitable for compression into high grade scientific briquettes, secured. This new industry opens up considerable prospects of development, nor only from the fuel standpoint, but the utilization of the resulting tar and the production of by products of considerable value. This is all matter for future research in the laboratory, and may lead to developments of the utmost importance to Canadian Industry.

Another paper, given by E. Levitt, described a method for the decomposition of Clays and Feldspars. This method possesses the merit of newness, and the lecturer claimed that a high yield of calcined alumina of extreme purity is obtained, and that the by-products are directly useable, or enter again into the cycle of manufacture with almost negligible percentage of loss. The process promises well, and should it be adopted on a manufacturing scale would obviate the importation of water glass and aluminum sulphate, both of which substances are used in large amounts in Canada.

The next meeting was held on December 16 in the Physics Building, McGill University, when Prof. Eve of the University, spoke on Wireless Telephony. A demonstration was arranged by the Marconi Company the wireless telephone being explained by D. R. P. Coates.

On February 20th a lecture will be given on "Chemistry and the Motion Picture" by C. E. Kenneth Mees, D.Sc., and on March 17th the paper will be "Water Supply Purification" by Jas. O. Meadows.

Canadian Sitka Spruce

The Dominion Forestry Branch has just issued a bulletin entitled "Canadian Sitka Spruce" —Its Mechanical and Physical Properties "which was prepared by Loren L. Brown, A.M.E.I.C., recently superintendent of the Forest Product Laboratories of Canada at Vancouver, B.C., and now British Columbia lumber commissioner

for Eastern Canada with headquarters at No. 1 Adelaide St., East, Toronto. This bulletin should be of interest to all users of softwoods, as Sitka Spruce posesses characteristics which make it valuable not only in building construction, but also to the factory trade. It can be obtained on application to the Director of Forestry, Department of the Interior, Ottawa.

EMPLOYMENT BUREAU

Situations Wanted

Electrical Engineer

An apprentice electrical engineer finishing term with Canadian General Electric Company, seeks employment in Montreal. Box 86-P.

Electrical Engineer

Graduate B.Sc. in electrical engineering, McGill University, 1921, desires position in electrical engineering work. Practical experience in electrical testing. Summer with Northern Electric Company, valuation with Dr. Herdt. References furnished on request. Box No. 88-P.

Mechanical Engineer

Engineer, Jr.E.I.C., age 23. Six months experience mechanical drafting, designing and engineering, including supervision over manufacture of special machinery, design of tools, jigs and attachments for the manufacture of iron working machine tools. Improvement of lathes, shapers, drills, grinders, pipe threading machines, tumbling mills and a thorough knowledge of hydraulic pumps. Desires change. Salary expected $160.00 per month. Apply Box 87-P.

Situations Vacant

Assistant Mining Engineer

3442. An Assistant Mining Engineer, Mining Lands and Yukon Branch, Department of the Interior at Calgary, Alta., at an initial salary of $2,100 per annum, which will be increased upon recommendation for efficient service at the rate of $120 per annum, until a maximum of $2,580 has been reached. This initial salary will be supplemented by whatever bonus is provided by law.

Duties.—To assist in making examinations of mineral deposits; in some cases to have charge of mining survey parties; to test mineral samples; to inspect refining mills, shops and plants which are engaged in concentrating, refining, or otherwise preparing mineral products; and to perform other related work as required.

Application forms properly filled in must be filed in the office of the Civil Service Commission not later than January 12, 1922. Application forms may be obtained from the office of the Employment Service of Canada or from the Secretary of the Civil Service Commission

By Order of the Commission.

W. FORAN, *Secretary.*

Members Exchange

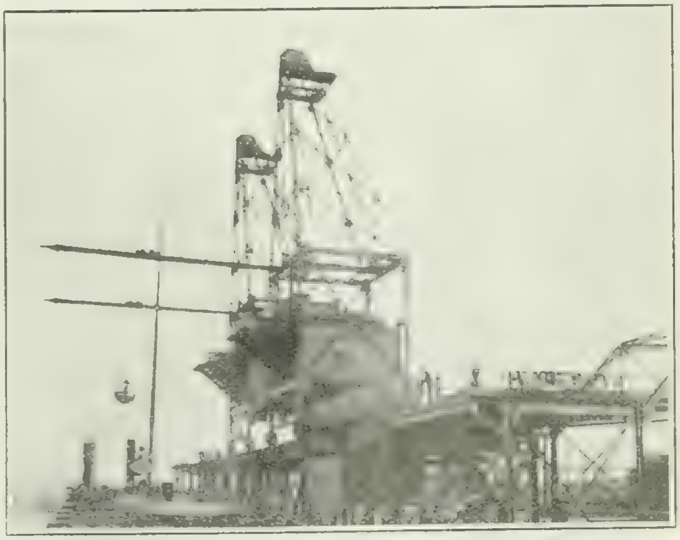
Offices to Rent

One or two very desirable offices are available for consulting engineers. In connection with the rental of these offices, telephone, stenographic and typewriter services are available, the telephone service being placed on the firm's exchange. These offices are also centrally located. Apply Box 19-A.

Imperial Oil Ltd. Coal Handling Plant at Sarnia

The oil refinery at Sarnia of the Imperial Oil Co. Limited, of which Thos. Montgomery is chief engineer, is the largest in Canada, and the consumption of coal in their water hogs and stills approximates 200,000 tons annually.

The coal is received at the dock in steamers specially constructed for this purpose, and carrying cargoes of 6,000 tons. This coal is taken from the hold of the steamer by movable towers, each equipped with an automatic grab bucket having a capacity of about 3,000 lbs. The hoisting of these buckets is accomplished by direct acting steam engines, one in each tower, and the operation of hoisting in each tower is accomplished by one man only. The coal is elevated a distance of about 50 ft. and discharges into cable cars running on an elevated trestle for carrying the coal across the railroad tracks and public street into the Imperial Oil yard, where the coal is discharged into a large pocket for distribution to the various portions of the plant by means of auto trucks.



The photograph shows the two unloading towers in operation; each tower has an unloading capacity of 250 tons per hour, giving a total of 500 tons for the two towers.

The present plant is laid out so that eventually the cable road conveying system can be extended a distance of about half a mile, so as to deliver coal direct to the various stills and power plants and also to the storage pile. The complete plant was designed, manufactured and constructed by the Canadian Mead-Morrison Company Limited.

British Industries Fair

The eighth annual British Industries Fair which embraces a large number of the most important lines of British trade, will be held in London and Birmingham from 27th February to 10 March. This is purely a trade fair where buyer and seller meet, not an exhibition. This Fair, whether regarded from the point of view of size, diversity of products shown or resultant business, now surpasses in importance and value to the world's markets any other trade fair or similar purpose. A visit to the Fair will convince overseas buyers that enormous strides have been made in Britain's post war production. A considerable number of Canadian buyers are making arrangements to attend. Admittance is restricted to trade buyers on invitation of the British Government and business is not impeded by crowds of sightseers.

While participation in the Fair is confined to manufacturers in the British Empire as exhibitors, many overseas buyers will undoubtedly continue to utilize the services of merchant houses who fill so important a role in the export trade of the United Kingdom. From the buyers' point of view, however, the Fair has the great advantage of personal contact with the actual producer.

The British Trade Commissioners in Canada will be pleased to give full particulars and to issue invitation cards to Canadian buyers who propose to visit the Fair at their following addresses:-

248 St. James Street, Montreal,
260 Confederation Life Building, Toronto,
610 Electric Railway Chambers, Winnipeg.

OBITUARIES

A. M. Phillips, A.M.E.I.C.

A. M. Phillips, A.M.E.I.C., died on November 15th in Kamloops, B.C., after a short illness from blood poisoning contracted through driving a splinter into his left thumb. He was born in August 1883 at Valleyfield, Que., and entered the Royal Military College at Kingston in 1901 graduating in 1904. On graduation Mr. Phillips entered the service of the Grand Trunk Pacific, serving for one year as instrument man in Northern Quebec; for two years subsequently he was resident engineer on the Napierville Junction Railway. In 1910 Mr. Phillips was appointed resident of the Grand Trunk Pacific Railway at Kenora, Ont.; in 1911 to 1917 he was resident engineer with the Canadian Northern Railway at Kamloops, and in 1918 he was appointed assistant engineer, Dominion Water Power Branch in the same city. Mr. Phillips was elected an Associate Member on April 9th, 1910.

J. Emile Girard, Q.L.S., A.M.E.I.C.

J. Emile Girard, Q.L.S., A.M.E.I.C., died suddenly, on July 14th, 1921, while he was aboard the S.S. Cape Diamond, on a vacation trip to the Saguenay. He was born on the 2nd. of December 1867 at Bécancour, county of Nicolet, P.Q., of Léger Girard and Eugénie LeBlanc. After attending a local academy, he completed his education at the Three Rivers Seminary and studied Land Surveying under G. P. Roy, Q.L.S., of Quebec, with whom he served during several years, and became a

J. EMILE GIRARD, Q.L.S., A.M.E.I.C.

member of the Corporation of Land Surveyors for the province of Quebec in 1890. In 1901, Mr. Girard was appointed to the Survey Branch of the Department of Lands and Forests, Quebec, as assistant to the director of surveys. In 1908, he became inspector of surveys for the Provincial government and, in 1910, director of surveys for the Province of Quebec. He was admitted in the Canadian Society of Civil Engineers, now *The Engineering Institute of Canada*, as an Associate Member in 1905.

Mr. Girard married Miss Blanche Fafard, of Quebec, in 1914. His residence was Quebec. He was well known and esteemed by many engineers and by all the Quebec Land Surveyors.

PERSONALS

T. H. Byrne, A.M.E.I.C., has been appointed road superintendent for Carleton County, Ont.

W. E. Keyt, A.M.E.I.C., has been transferred by the Department of Public Works to Nelson, B.C.

J. F. F. Mackenzie, Jr.E.I.C., is now with the Dominion Bridge Company Limited, at Lachine, Quebec.

A. G. McLerie, A.M.E.I.C., formerly with the Laurentide Co. Ltd., is at present with the Royal Canadian Air Force at Camp Borden.

E. S. Miles, A.M.E.I.C., formally of Matane, Que., is now with Doheny, Quinlan & Robertson, Limited, at Thorold, Ont.

L. H. Wheaton, A.M.E.I.C., has been appointed Commissioner of the Joint Expenditure Commission to the County of Cape Breton.

A. T. Perrin, A.M.E.I.C., has been appointed plant and equipment engineer for the Parker Motor Car Company, Limited, at Longue Pointe, Que.

E. C. Girouard, A.M.E.I.C., has opened an office as manufacturers' broker and agent at 224 St. James St., Montreal. Mr. Girouard is particularly interested in contractors' plant.

W. D. Coulter, S.E.I.C., formerly with the Farris Bridge Company, at Cumberland, Maryland, is now in the drafting department of the Lackawanna Bridge Company, at Buffalo, N.Y.

E. L. Miles, M.E.I.C., has received the appointment of county engineer, to be combined with his regular duties as county road superintendent for the County of Victoria, Ontario. Headquarters, Lindsay.

Captain G. V. Douglas, A.M.E.I.C., has joined Sir Edward Shackleton's expedition to the Antarctic and sailed South with the exploring party in the "Quest". The good wishes of every member of *The Institute* go with Captain Douglas.

H. R. McClelland, M.E.I.C., has left for an extended business tour in Great Britain. Mr. McClelland is an active member of the Montreal Branch, and recently delivered a very interesting paper to the Branch on Shipbuilding.

Herbert P. Heywood, A.M.E.I.C., is superintending construction of the Muddy Run Trunk Sewer, Niagara Falls, Ont., as resident engineer. Mr. Heywood designed this sewer for James, Proctor, and Redfern, consulting engineers, the cost of the work being $250,000.

J. A. Burnett, A.M.E.I.C., will carry on the business of the consulting engineering firm formerly known as Smart & Burnett. V.I.Smart, M.E.I.C.has been appointed by the Government in connection with appraisal work. It is Mr. Burnett's intention to carry on his consulting practice, and specialize in appraisal work.

Charles E. Fraser, M.E.I.C., James H. Brace, M.E.I.C., and George C. Clarke, M.E.I.C., have issued an attractive year-book for 1920 of Fraser, Brace Limited. The purpose of the book is to give an idea of the variety of the work undertaken by the firm. It is attractively printed with many illustrations.

Donald L. Derrom, M.E.I.C., who has spent the past few months in Montreal, and was particularly active as having been in charge of the Service Department of the McGill Reunion, has accepted a position as mechanical engineer with the Dominion Atlantic Railway, with headquarters at Kentville, N.S.

H. R. Safford, D.Sc., M.E.I.C., is to be congratulated on the further evidence of his success, as indicated by a recent announcement of the President of the Chicago, Burlington and Quincy Railroad Company, advising that at a meeting of the Board of Directors held on December 1st, Mr. Safford, assistant to the president, was elected vice president to the company. Mr. Safford's friends in Canada will be glad to hear of this promotion.

Geo. B. Mitchell, M.E.I.C., manager of the Foundation Company at Lima, Peru, has presented to *The Institute* a copy of the Centennial edition of the West Coast Leader of Lima, Peru. The Centennial edition gives an immense amount of information as to present conditions in the republic of Peru and gives an insight into the remarkable energy and foresight of Canadian British and American firms which have helped to develop the resources of the country.

Geo. W. Craig, M.E.I.C., Chairman of the Calgary Branch has just returned from an extended tour through the central States, during which he attended two engineering meetings, giving an outline of the work that *The Institute* is doing for engineers in Canada, especially emphasizing the activity of *The Institute* in legislative matters and the individual attention given to members. Mr. Craig was gratified to note the interest taken in the work of *The Engineering Institute* by engineers whom he met on his visit.

W. G. Macnaughton, A.M.E.I.C., recently of Kapuskasing, Ont., and formerly of Spokane, who has for many years been connected with the pulp and paper industry as professional engineer, has accepted the secretaryship of the Technical Association of the Pulp and Paper Industry, with headquarters at 18 East Forty-first Street, New York City, succeeding T. J. Keenan, who has retired as editor of the paper. Mr. Macnaughton will also edit a section of the Paper Trade Journal, which is acting as the official organ of the Pulp and Paper Association.

J. G. SULLIVAN, M.E.I.C.
President - elect for 1922

Boyd Candlish, A.M.E.I.C., announces that he has just appointed an assistant who will reside permanently in Hamilton. Mr. Candlish is chief engineer of the Herbert Morris Crane & Hoist Company Limited, of Niagara Falls, and is a specialist in lifting machinery. Mr. Candlish will continue as heretofore to make frequent visits to Hamilton for the purpose of working out problems in lifting and transporting, but his assistant, Mr. Fred Simpson, is competent to lay out the preliminary lines of such studies, and Mr. Candlish's friends will be pleased to know if his presence there.

Horace L. Seymour, C.E. (Toronto), A.M.E.I.C., town planning engineer of the firm of Frank Barber and Associates Ltd., consulting engineers, Toronto, has been retained as city planning consultant to the city of Niagara Falls, Ont., in which connection his first work will be to consult with Carl Gardner, B.A.Sc., A.M.E.I.C., in the preparation of study maps and data, which will form the basis of zoning maps and proposed zoning ordinances, as well as for other features of a city planning scheme. This is a feature of municipal work which has been seriously neglected, and the city of Niagara Falls is to be commended for its up to date policies which are sure to have beneficial results.

G. T. Clark, M.E.I.C., addressed the Engineering Society of the University of Toronto on November 23rd, on the organization of engineers in general and *The Engineering Institute* in particular. Mr. Clark first spoke of the need for organization in the engineering profession, one of the most important of the present day, and then dealt with the organization developed by *The Institute.* He traced the growth of the Canadian Society of Civil Engineers from the days when the civil engineer could handle every branch of the profession to the present day when every engineer is perforce a specialist. He pointed that the Canadian Society of Civil Engineers had kept pace with the changing conditions and had been re-organized under its present title with a remarkably flexible constitution. Mr. Clark showed that membership was a mutual benefit to *The Institute* and the member in the exchange of ideas and the promotion of technical knowledge. In conclusion the splendid work of *The Institute* in protecting the public from the impostor and in maintaining a high moral code were indicated.

BRANCH NEWS

Vancouver Branch

P. H. Buchan, A.M.E.I.C., Secretary-Treasurer.

The Annual Meeting of the Branch was held on Dec. 21st, when the following matters were disposed of

Election of new Branch Officers:—

Chairman, Chas. Brakenridge, M.E.I.C.

Vice-Chairman, A. C. Eddy, M.E.I.C.

Secretary-Treasurer, P. H. Buchan, A.M.E.I.C. 930 Birks Building.

Executive: J. N. Anderson, A.M.E.I.C.; Wm. Smaill, M.E.I.C.; Major-General R. G. Edwardes Leckie, C.M.G., A.M.E.I.C.

The Chairman, Vice-Chairman and Secretary-Treasurer are elected for the year 1922, and the three members of the Executive Committee named for the years 1922 and 1923, there being three members of last year's Executive Committee acting for a second term, as provided in the By-law.

The amendments to the by-laws were both carried, the first by a majority of 54 to 1, the second by 49 to 3.

The matter of suggested meeting of Branch Secretaries was discussed and was referred to the Executive Committee to go into more fully.

The letter of Council regarding the suggested arrangements with the B. C. Technical Association was read and discussed and was also referred to the Executive Committee to consider before sending to the B. C. Technical Association.

Meeting of Association of Professional Engineers of British Columbia.

The following report has been received from E. A. Wheatley, A.M.E.I.C., Registrar of the Association of Professional Engineers of the Province of B. C.

The Second Annual General Meeting of the Association of Professional Engineers of the Province of British

Meeting of Association of Professional Engineers, British Columbia.

Columbia was held on 3rd December, in the Rose du Barry room of the Hotel Vancouver and commenced at 11 o'clock in the forenoon; after the usual passing and adopting of the 1920 minutes, Major W. G. Swan, D.S.O., M.E.I.C., chief engineer of the Harbour Commissioners and president of the Association during 1921, addressed the meeting. During the year the membership of the Association had grown to 754 and on account of nine resignations and the death of five members, which had been a blow to all engineers in the province, the actual number at the time was 740.

The chairman drew attention to the fact that 116 applications had been unavoidably rejected although the Council had been fairly lenient with applicants and had made it a point of policy that if an applicant had been obtaining his living by carrying out engineering work, even if his qualifications did not approach the standard desired, he had been granted membership in the Association. Major Swan thought that the Association was now on its feet. In the future qualifications would be made more stringent and possibly later it would be necessary that all applicants should have diplomas or college degrees before admission.

Major Swan referred to the question of joint quarters and joint staff with other engineering bodies, which had been recommended at the last Annual Meeting, and informed the meeting it had been found impossible to arrange for a joint staff, but he was very happy to be able to report that joint quarters had been arranged; and not only with *The Engineering Institute of Canada*, Vancouver Branch, and ours, but also with the British Columbia Technical Association, Vancouver Section of the American Institute of Electrical Engineers, the Institute of Architects and a small Chemical Society, which made altogether some six Associations housed under one roof.

The Chairman commented on their indebtedness to *The Engineering Institute of Canada* for allowing their library to be opened to all the members of these Associations, and drew attention to the need of the appointment of various committees, including a legislative committee, who should, in the light of past experience go in detail through the Act and make recommendations to the Council of necessary changes. Also a library committee should be considered in the hope that they might finally obtain a library which should be up to date and of the greatest use to all the engineers, whatever their branch, who are members of the Association.

The result of the ballot was declared as follows:— D. O. Lewis, M.E.I.C., President, J. M. Turnbull, Vice-President, and G. A. Walkem, M.E.I.C., A. E. Foreman, M.E.I.C., J. Muirhead, M.E.I.C., and H. L. Johnston, M.E.I.C., members of Council. Major Swan invited the new President, Mr. Lewis, to address the meeting. Mr. Lewis briefly remarked on the great amount of work which was in front of them all and assured the meeting that anything in the interest of the engineers appealed very greatly to him and he would use his best endeavours to carry out their wishes and commands.

A number of changes of by-laws were introduced and passed. It was agreed and arranged that the incoming Council should endeavour to have round table conferences with *The Engineering Institute of Canada* and the British Columbia Technical Association, with a view to the Associations working together or co-operating in the interests of all engineers. This is considered a very important step in the right direction.

One hundred and fifty members were present at the meeting, which was marked throughout with a great deal of enthusiasm. A vote of thanks was extended to the retiring President for the energy, keenness and success with which he and the Council had conducted the affairs of the Association during 1921, to which Major Swan replied that it had been nothing but pleasure to work for them inasmuch that all the members of the Council had shown such interest in the affairs of engineers.

In the interval between the morning and afternoon sessions, a luncheon was held in the Hotel Dining room, and later a group photograph of the members was taken on the Court House steps.

Local News.

F. J. Whittaker, A. M. E. I. C., municipal engineer for South Vancouver has been appointed city engineer of Prince Rupert, B.C., and will commence his new duties about 15th December.

The Vancouver Branch has moved to 930 Birks Building, where joint quarters are being maintained with the Association of Professional Engineers of the Province of B. C., the Architectural Institute of B. C., the B. C. Technical Association, the Vancouver Section of the American Institute of Electrical Engineers and the Chemical Society.

The suite consists of a general office, board room secretaries room and reading room and library.

Calgary Branch

Arthur L. Ford, M.E.I.C., Secretary-Treasurer.
Floyd K. Beach, A.M.E.I.C., Branch News Editor.

Meeting of Association of Professional Engineers

On November 26th, a meeting was held in Calgary of the Association of Professional Engineers of Alberta. This meeting, while not of members of *The Institute* as such, was attended by many of them who are also members of the Association formed as a result of efforts started by *The Institute* to secure legislation.

Prior to this meeting there may have been a feeling that the legislation so far secured is of little practical value. At the close of the meeting that feeling had not only been dissipated, but all present felt that a real step toward the advancement of the profession has been achieved in the legislation secured, in its resulting organization of engineers of the province practising in all branches, and in the raising of ethical standards.

R. A. Brown, president of the Association opened the meeting by a very forceful talk outlining the work so far done. He pointed out that whereas the legislation secured provided only a protection for the name Professional Engineer, subsequent legislation respecting various undertakings in the province, such as the Irrigation Districts act, have provided that only a Professional

Engineer may do certain things. Attention was drawn to difficulties that have been met in passing on the credentials of various applicants for admission to the association, due in many cases to indefinite statements on the application form. Possibly some applications have been rejected that would have been accepted if they had been in clearer form and it is equally possible that some had been admitted whose qualifications were not as high as they should have been. At all events, legislation is admitted to be unjust if it takes away a man's livelihood, and if a man has made his living by the practice of engineering, we must allow him to continue, while restricting the entrance of new men until they can show their worth and right to practise.

The question of dual registration was raised. Should engineers be registered in two or more branches of engineering? The general feeling was that it was probably unwise to recognize legally any but the term Professional Engineer. The various branches were recognized within the Association for purposes of equal representation on the council. In any event, it is unwise to make any move toward amendment of the act, and those engineers who wish dual registration should receive it on proof of being entitled to it. The fact that registration is or is not made in a certain branch should have no bearing on the rights to discipline members for practise that shall endanger the public security of life or property.

The meeting, which was held in the afternoon in the Board of Trade rooms, was followed by a banquet and musical programme. R. A. Brown presided throughout and proved himself a most able chairman, bringing several delicate situations to a point of agreement.

Engineers and the Law

When a married man loses his own money he has himself to blame and his wife to blame him, but if an engineer causes clients to lose their money he has not only the losers to blame him, but he may make himself amenable to the law.

When dealing with companies and corporations, the engineer should know the ground upon which they stand before risking much of his own time and talent or before allowing a client to risk his money. It would appear that the only competent authority to pass on the rights of a company to contract, is a lawyer well versed in corporation law.

This very briefly is the meat that engineers can draw from a very able talk given by Alexander Hannah, barrister, of the firm of Lougheed, Bennett, and Company, to the Calgary Branch on December 2nd. In opening his talk, Mr. Hannah remarked that the subject he was to cover in an evening is one to which twenty or more lectures are assigned in a law school, and on which many lengthy volumes have been written, so that only salient features could be outlined. The reviewer is very diffident, being an engineer, in reporting Mr. Hannah's talk, which was so full of meaning as to leave one with the impression that hardly a phrase could be taken away from it without disturbing the meaning of the whole.

A corporation is regarded as a legal person. Since the fiction is admitted, the powers which it possesses must be fixed in some manner by law. Corporations may be classified as to size; the words trust, corporation, and company being variously used. Ordinarily a concern such as the Canadian Pacific Railway or the City of Calgary being entitled to the name of corporation, while the word company usually refers to a smaller concern.

Again, they may be classified as to the origin of their authority to do business. A Royal Charter endows the concern with the furthest reaching powers. Incorporation may also be obtained from the Dominion or the Provincial government by letters patent or by memorandum of association, or by an act of parliament (or act of legislature).

The Hudson's Bay Company is an outstanding example of incorporation by Royal Charter. Its powers cannot easily be questioned anywhere within the empire. The case of the Bonanza Creek Company was cited. In that case there was an association authorized to do business in Ontario, which went into the Yukon. Its right to hold mining lands in the Yukon was questioned and it took its case to the Privy Council. That body rested its decision on the form of incorporation which had been obtained from the Lieutenant Governor of Ontario under the great seal of that province. The ruling was that the company had rights flowing from the crown and were entitled to do business elsewhere than in Ontario.

Public service corporations, such as the City of Calgary, the Canadian Pacific Railway, the Gas Company, etc., require the right of expropriation. This right can be granted only by an act of parliament, so that in dealing with a company that may need this right, it is necessary that it be incorporated by an act that the act specify the right.

Further the speaker pointed out that, if a company is not incorporated in the province in which it is doing business, it is necessary to investigate and ascertain that it has obtained rights to do business in the province, as otherwise money might be tied up indefinitely while the courts thresh-out its rights.

A controversial subject is entered when discussing the merits of letters patent as against the merits of registration by memorandum and articles of association. Mr. Hannah stated there is much to be said in favour of registration of the regulations of a company in that for a small fee anyone could obtain from the provincial registrar full details of the powers of a company. In the case of letters patent, a company is regulated by its by-laws, and by-laws may be written and amended by the directors of the company. Unscrupulous directors might do many things harmful to the stock holders or to persons doing business with the company.

Mr. Hannah mentioned that articles of association may be written out in full, outlining all powers as desired, or they might be in a short form with reference to "Table A", an Alberta form which is now very antiquated. It provides, for example, that the office of a director shall *ipso facto* be vacated if he accept a contract or office of profit to himself from his company

A more sensible by-law or rule is that a director must declare his interest at a meeting of directors, and having so declared his interest, he is free to contract as an individual.

Contracts may be signed by authorized directors of a company without the seal of the company but in such

cases as an individual would use a seal, the seal of the company is affixed. The signature of one or more directors of the company then becomes merely a witness to the fact that the seal of the company was purposely and knowingly placed. Mr. Hannah then outlined where the seal of an individual or company is required.

Companies are sometimes looked on as a means of losing money quickly. Probably a lack of knowledge of what they can and cannot do would save many investors from losing their money. For example, in 1914 many people lost money in the oil boom who should not have done so had they inquired into their rights. A minimum suscription clause, for example, actually existed in some cases, and though the minimum subscription was not obtained the money actually subscribed was not returned.

In considering Mr. Hannah's talk as a whole, it was an impressive exposition of the value a lawyer has in any organization scheme of which a company is one factor.

Local News

Captain Hobart R. Carscallen, M.C., A.M.E.I.C., has been promoted to the position of office engineer in the irrigation division of the reclamation service at Calgary, and has removed from Ottawa where he has resided since returning from overseas. Captain Carscallen lost a leg while serving in France with the Canadian Engineers. This disability combined with his experience in irrigation work prior to going overseas and his genial disposition has made his promotion very acceptable to those who know him and have to work with him.

Angus Smith, M.E.I.C., has just been elected city commissioner for Calgary. He appealed to the electors on his record as city engineer for Victoria, Regina and Prince Albert, and defeated the present incumbent of the office by a small majority in the face of opposition by both newspapers. As he was comparatively unknown to the majority of electors, his success may be taken as a compliment to the profession as well as to himself.

Winnipeg Branch

Geo. L. Guy, M.E.I.C., Secretary-Treasurer.
E. V. Caton, A.M.E.I.C., Branch News Editor.

At a meeting of the Branch which was held on the 1st December, E. P. Fetherstonhaugh, M.E.I.C., in the chair, a series of films illustrating the paper making industry was shown.

D. A. Ross, M.E.I.C., read a short synopsis of the various methods of manufacturing wood pulp and paper, which was listened to with considerable interest by the members. The growing interest which is being taken in the paper industry in the West and the prospects of the installation of pulp mills in the Winnipeg district resulted in a large attendance.

Local News

J. G. Sullivan, M.E.I.C., was re-elected for alderman at the recent municipal elections.

Foundations In and Around Winnipeg

At a regular meeting of the Branch, held in the Engineering Buildings, Manitoba University, on the 9th. December, E. P. Fetherstonhaugh, M.E.I.C., in the chair, a paper on "Foundations In and Around Winnipeg" was presented by Harold Edwards, M.E.I.C., this paper being a summary of all information collected by a large Committee which has been working on the subject for some time.

The paper was introduced by a short description of the geological history and formation in and around Winnipeg, given by P. Burke Gaffney, M.E.I.C.

Mr. Edwards opened his address by emphasizing the very contradictory information the Committee has received and emphasized the necessity for more careful observations by the members and those interested to insure accurate information being obtained. He pointed out the condition of rock in the Winnipeg district, in which there appeared to be no regularity of elevation which could be relied upon, nor did there seem to be any general trend for the slope of the rock in any direction. Borings within short distances of each other showed considerable differences in the elevation of the rock and from a large number of results which have been obtained, spread over practically the whole Winnipeg area, there does not seem to be any definite line of rock elevation in the district. The usual covering over the rock, after the first foot or so of mould, was clay; boulders, hard pan, and gravel was found immediately over the rock, but in many cases exceptions to this were found, such as quicksand, soft blue clay under the hard pan and in one case a soft mushy clay immediately over the hard pan. The clay covering over the hard pan also varied greatly from a stiff yellow clay to a soft blue clay and in many cases a poor marle was found. The rock itself varied in places; in one case the layers were very soft and easily broken with a hammer. In many cases before reaching the true rock a layer of soft broken rock was found. In some cases layers of clay were found under the rock. Another point which required careful investigation was the water level under the soil. This had been found to vary from place to place and as a matter of fact several authentic cases were given where the water level within a short distance had varied considerably at the same time. It was also found that the water level varied from time to time and evidence pointed to this being somewhat dependent upon the state of Lake Winnipeg, although it was not sufficiently proved to be accepted without further investigation.

The speaker emphasized the necessity in all foundations for uniformity of loading. He suggested that a load of 4,000 lbs. per square foot (live and dead) should not be exceeded until some definite information had been obtained, as investigations show that buildings which had exceeded this loading had shown signs of trouble. Against this, however, he pointed out that buildings having a load of 7,000 lbs. per square foot were still in perfect condition.

The speaker concluded with impressing upon the members the necessity for co-operation from everybody in this investigation and requested that the Committee be notified of any condition which appeared to be unusual when foundations were being excavated or in borings being made in the district. He also emphasized the necessity for careful watching the question of water level in

the soil, as in his opinion this was one of the most important matters which affected the stability of foundations built on the Winnipeg clay.

Upon a motion before the Branch, the standing Committee on Foundations was reappointed to continue these investigations and the meeting concluded with a hearty vote of thanks to the speakers.

The meeting was largely attended and a live discussion took place, many interesting points being brought out

Lethbridge Branch

C. M. Arnold, M.E.I.C., Secretary-Treasurer.

On December 3rd the Corporate Members of *The Engineering Institute* resident in Lethbridge held an organization meeting at which the Lethbridge Branch was brought into being. The following officers were elected to serve until the regular Annual Meeting of the Branch in March : Chairman, Sam G. Porter, M.E.I.C.; Secretary-Treasurer, C. M. Arnold, M.E.I.C.; Executive Committee, G.N. Houston, M.E.I.C., C. D. MacKintosh, A.M.E.I.C., H.W. Meech, A.M.E.I.C.

Following the enthusiastic preliminary meetings which have been held in Lethbridge, it is expected that the new Branch will quickly blossom into one of the most active in *The Institute.*

Border Cities Branch

J. Clark Keith, A.M.E.I.C., Secretary-Treasurer.

The annual meeting of the Branch was held in the Cadillac Cafe, Friday evening, December 9th.

The reports of the officers and committees for 1921 were received, and on motion of M. E. Brian, A.M.E.I.C., seconded by H. C. McMordie, A.M.E.I.C., the reports were adopted.

The meeting then prodeeced to the election of officers for the year 1922. The following officers were elected:

Chairman	Geo. F. Porter, L.L.D. M.E.I.C.
Secretary-Treasurer:	J. Clark Keith, A. M. E. I. C.
Executive Committee:	A. J. M. Bowman, A. M. E. I. C
	L. M. Allan, A. M. E. I. C.
	H. C. McMordie, A.M.E.I.C

Niagara Peninsula Branch

R. P. Johnson, A.M.E.I.C., Secretary-Treasurer.
G. R. Taylor, A.M.E.I.C., Branch News Editor.

Power Development at Niagara Falls

About 125 members and friends sat down to dinner at the Lafayette Hotel on the evening of December 6th with F. S. Lazier, M.E.I.C., Branch Vice-Chairman in the chair. After dinner, J. L. Harper, chief engineer of the Niagara Falls Power Company, gave a very interesting illustrated address on Niagara Falls, the problems of power development there and the particular work of his own company. Mr. Harper outlined the various stages in the power development of the Falls from 14,000 H.P. twenty years ago to the 1,000,000 H.P. of the present day and he argued for a still larger development, outlining a plan whereby 60% of the water could be utilized without affecting the scenic effects.

Mr. Harper gave some very interesting information in regard to the 32 foot pressure tunnel his company has now under construction for the supply of water power for their 70,000 H.P. generators which will bring their total output up to 400,000 H.P. when they will be getting twenty horse power per cubic foot of water used instead of ten as in some of their old plants. He stated that in past years by better design of tail races and draft tubes a gain of 5% in efficiency had been effected.

Among other interesting items Mr. Harper mentioned that their transmission cable to the Aluminium Company had an area of 144 square inches and was possibly the largest in existence.

Two moving picture reels were shown, one illustrating the scenic beauties of the Falls and the other the importance of the industries at Niagara Falls utilizing power, particular stress being laid on the abrasive industries, the necessity for a large supply of electric power for their furnaces and their great importance in the whole industrial life of the country.

A very hearty vote of thanks was extended to Mr. Harper for his kindness in coming to address the Branch and for his most interesting lecture.

Hamilton Branch

W. F. McLaren, M.E.I.C., Secretary-Treasurer.

The Annual Banquet of the Branch was held in the Royal Connaught Hotel, on 24th November, 1921, at 6.30 p.m., with E.H. Darling, M.E.I.C. presiding. Brig.-Gen. C.H. Mitchell, C.B., C.M.G., D.S.O., Dean of the Faculty of Applied Science and Engineering, University of Toronto, was guest of honour, and Messrs Geo. C. Martin, Chamber of Commerce, and F.R. Close, Board of Education, were also invited. Musical selections were rendered during the evening and songs sung by the members.

Mr. Darling introduced Mr. Martin who outlined some of the activities of the Chamber of Commerce, many of which dealt with engineering problems. He said that engineers of high technical training should devote some of their talents to municipal affairs and hoped that many would become members of the Chamber of Commerce.

Mr. Close described some of the difficulties of the board of education caused by the rapid growth of the city requiring new schools with all the latest appliances for ventilation demanding the highest skill of the architect.

J. W. Tyrrell, M.E.I.C., one of the earliest graduates of the Faculty of Applied Science of Toronto, then introduced Brig.-Gen.C.H. Mitchell, C.B.,C.M.G. etc; who said that in Mr. Tyrrell's time there were 3 graduates in Civil Engineering while now there are about 57 varieties of engineers: whereas Civil used to take first place in point of numbers, now it was down to fourth place. There are over 800 students taking engineering courses. They are divided up as follows:-

Electrical Engineering	....	290
Chemical "	....	175
Mechanical "	....	160
Civil "	....	130
Mining "	....	55
Architectural "	....	32

Formerly, civil engineers were engaged on large construction work, but now we are in an industrial period requiring specialists in the scientific technicalities of the various branches of manufacturing.

The Engineering Institute combines all branches and extends from coast to coast. It is a sign of the times that all branches of engineers are getting together. Canada is essentially an agricultural country and always will be; but we must have transportation, shipping, including docks and harbours, canals, electric railways, aerial navigation, highways, water supply, sewage disposal, bridges, town planning architecture, mining as in Labrador and Northern Ontario and other parts. Then there are the great basic manufactures, iron and steel, milling, wood, cement and clay products and clothing. All these will require engineering ability more and more as time goes on. Plants employed on war work are being adapted to peace industries, as at Shawinigan where acetone is giving place to acetylene. In Saskatchewan they are now making Epsom salts and similar chemicals in place of explosives. These chemical industries will require chemical engineers. When we consider all these possibilities, we realize the complexity of engineering in its broader sense.

We engineers are not taking enough part in the affairs of the country. We are assistants to those who are running things, but we are not running things ourselves. Engineers, educated in highly endowed universities, owe it as a duty to place their special knowledge at the service of the community. They should take a more active interest in politics by serving on municipal boards and joining the Chamber of Commerce in their localities— Don't ask "What do I get out of it?," for you will get out all that you put in.

The vote of thanks was moved by H. U. Hart, M.E.I.C., chief engineer and general manager of the Canadian Westinghouse Co., and was carried amid loud applause, thus closing a most successful gathering at which over 100 engineers were present, including representatives from Brantford, Simcoe, and Dundas.

Local News

It will be noted that Mr. Hart, having resigned the Chairmanship of the branch some weeks ago, owing to pressure of work, E. H. Darling, M.E.I.C., consulting engineer, had been chosen by the executive to fill the vacancy. The cigars supplied for the dinner by Mr. Darling were greatly appreciated.

Toronto Branch

F. B. Goedike, M.E.I.C., Secretary-Treasurer.
C. R. Young, M.E.I.C., Branch News Editor.

Electricity Applied to Railway Signalling

The development of railway signalling through the application of electricity was discussed in a comprehensive manner at the meeting of the Branch on November 24 by C. H. Tillett, signal engineer for the Grand Trunk Railway. Mr. Tillett described the methods of signalling from the elementary device of the banner and lantern to the elaborate block and interlocking signalling installations now being used on first-class lines. The address was fully illustrated by lantern slides.

Social Service

At the meeting held on December 1st, Professor J. A. Dale, of the Social Service Department of the University of Toronto, addressed the Branch on "What Constitutes Social Service". According to the speaker's definition, social service consists of "the modern practice of the principles of the Good Samaritan worked out in a scientific way, as a result of centuries of experience and study".

In the discussion which followed the address, various speakers expressed their interest in the application of the principles of social service to industry and the problem of employment.

The report of the Committee on Sociology was submitted by its chairman, T. L. Crossley, M.E.I.C., who also presided at the meeting.

At the meeting of the executive held on the same evening, Willis Chipman, M.E.I.C., was named as the Branch representative on the Provincial Division.

Toronto Park System

The park system of Toronto was interestingly described and illustrated with an excellent collection of lantern slides by Chas. E. Chambers, commissioner of parks, Toronto, at the meeting on December 8th.

J. M. Oxley, M.E.I.C., Wm. Storrie, M.E.I.C., G. G. Powell, M.E.I.C., G. W. Winckler, M.E.I.C., and others took part in the discussion.

Street Illumination

A. G. Lang, of the Hydro-Electric Power Commission, gave an address on street illumination, illustrated by lantern slides, at the meeting on December 15th. R. O. Wynne-Roberts, M.E.I.C., G. W. Winkler, M.E.I.C., A. C. Oxley, A.M.E.I.C., and others took part in the discussion.

A resolution was carried by the meeting instructing the executive of the Branch to request the city authorities to have all street names illuminated.

At the meeting of the executive held on this date, G. T. Clark, M.E.I.C., Wm. Storrie, M.E.I.C., and H. J. Lamb, M.E.I.C., were appointed representatives to attend the meeting of the Provincial Division executive in Toronto on December 17th.

Students' Night, Toronto Branch

On November the twenty-eighth the Student Members of the Toronto Branch held a very successful meeting in Hart House at which about one hundred persons were present. Papers were presented by four undergraduates in a very creditable manner. A great deal of credit is due A. W. McQueen S.E.I.C., and A. M. Reid, S.E.I.C., for the organization and management of the meeting.

Mr. Reid in opening the meeting expressed the appreciation of the Student Members to the Toronto Branch of the *E. I. C.* and especially to Messrs G. J. Clark and R. O. Wynne-Roberts for their invaluable assistance.

The first paper on Railway Electrification was given by Harold S. Weldon, S.E.I.C., The history of the electric locomotive was traced, noting the outstanding

points in its development, including increased ventilation, magnetic blow-out type of controller interpole, with the consequent increased range of commutation, and also the improved mechanical construction of the motors. The advantages of railway electrification such as improved service, increased speed, and lower maintenance costs were reviewed. Mention was also made of the different systems of electrification, and of the automatic sub-stations now in use.

R. I. Wynne-Roberts S.E.I.C., then spoke on "Waste and its Possibilities" He indicated the origin of waste and defined his subject as "Waste is simply raw material in the wrong place". The speaker developing this definition, pointed out the interesting commercial evolution of waste to a product of value, and emphasized the important bearing the exploitation of waste products has upon the wealth of the nation. He illustrated his remarks by allusion to the various successful applications that have already been made in the world of industry. In his opinion the future of the waste disposal problem lies in the full scientific utlization of waste and the establish ment of a recognized market, to give all waste material definite accepted value;

The address by W. J. McLelland S.E.I.C., on water softening by the zeolite process proved very interesting. Mr. McLelland has had considerable experience both in installing and selling "Permutit" softeners so he was very conversant with his subject.

The outstanding points of this method of softening water, impressed upon all present, were the simplicity of operation, the thoroughness with which the "Permutit" removed the hardness-as demonstrated by a small working model-and the little care such a method required.

When Mr. McLelland had finished, the subject was left open for discussion, whereupon several interesting and instructive points were raised concerning the method of operation of this type of softener.

In presenting the paper on Unemployment, Mr. A. W. McQueen defined his subject as "involuntary idleness in the sphere of work for wages." He then went on to state that any attempt to solve the problem of unemployment must be preceded by a through study of the whole subject matter of economics. Western industrialism, the speaker continued, had been built up on two main ideas. First, the production of material wealth and the resultant commodities exchanged in free competition and second, that services were also a commodity to be exchanged in free competition. Unemployment is one of the evils resulting from hindering this free play of competitive forces and is caused wholley by maladjustment between wage rates and the demand for labour.

In the discussion which ensued besides several students the following took part: G. T. Clark, M.E.I.C.; R.O. Wynne-Roberts, M.E.I.C.; Professors P. Gillespie, M.E.I. C.; C. R. Young M.E.I.C.; J. R. Cockburn, M.E.I.C.

A. M. Reid, S.E.I.C., presided at the meeting.

Peterborough Branch

D. L. McLaren, A.M.E.I.C., Secretary.

The City of Peterboro has for a number of years been considering the installation of a sewage disposal plant. A difference of opinion as regards the system best suited to the needs of the City existed between the city engineer and the Ontario Board of Health.

In view of the criticism directed towards the city engineer by a representative of the latter organization at a meeting of the city council, a resolution was passed by the executive of the local Branch at a meeting held on December 5th, and the following is a copy of same:—

"Resolved, that while recognizing that the system of sewage disposal best suited to the needs of the City of Peterborough is a question of debate, we, the executive of the Peterboro Branch of *The Engineering Institute of Canada* hereby express our confidence in Roy H. Parsons, M.E.I.C., city engineer, Peterborough, knowing that he will be governed in advice to the city by scientific and economic principles only, and that a copy of this resolution be sent to the city clerk."

Automatic Stations

On Thursday Dec. 8th, G. R. Langley, M.E.I.C., switchboard engineer, for the Canadian General Electric Co., Ltd., gave an address to the local Branch on "Automatic Stations". The speaker dealt with automatic stations both of the railway and hydro-electric type and showed conclusively that the equipment for such stations is not complex as commonly believed, but perfectly standard in every respect.

Kingston Branch

L. T. Rutledge, M.E.I.C., Secretary-Treasurer.

Life of Sir Sandford Fleming

A regular meeting of the Branch was held in Convocation Hall, Queen's University, on November 22nd. at which Professor Peter Gillespie, M.E.I.C. of the University of Toronto gave a very interesting address illustrated with lantern slides on the life and career of Sir Sandford Fleming, an eminent engineer and a late chancellor of Queen's University.

Prof. Gillespie reviewed many of the details of the early life and education of Sandford Fleming. He then dwelt at length on the pioneer work done by him along with other noted men in the development of the Great West at the time when the Canadian Pacific Railway was being surveyed and afterwards constructed. The speaker enumerated many instances of hardship and privation met with in the mountain fastness where the snow was so deep and the cold so intense. Sir Sandford laboured with untiring energy as a chief engineer during the years of the construction of the railway roadbed and it was interesting to note that he was present at the ceremony of driving the last spike on the mountain division. The picture which illustrated this ceremony showed Sir Sandford standing beside two honored empire-builders known to us as Sir William Van Horne and as Lord Strathcona.

The strong personality, the steadfastness of purpose, the adherence to principles of right, the honesty, integrity and the high moral character of the man were characteristics well brought out and illustrated by the speaker. The impression left on the mind of every person was that Sir Sandford Fleming's name occupies a high position in the list of those great men who have been the ornaments and benefactors of the Canadian race.

Iron Ores of Canada

The next meeting of the Branch was held on December 13th., at which meeting Prof. Stanley Graham, professor of mining engineering, Queen's University, gave a very instructive paper on the "Iron Ores of Canada". Prof. Graham treated the subject in a logical order as is revealed by the following synopsis:-

1. History of the development of iron mining in Canada with statistics and comparisons with other iron ore producing countries.

2. Iron ore and its impurities. The conditions effecting the value of it as a marketable product.

3. Value of Canadian ores in comparison with our U. S. competitors.

4. Treatment of low grade ores to make them marketable.

5. Concluding discussion on the probable future of the Canadian iron ore industry with suggestions as to means that might be used to stimulate the industry.

The speaker explained in the first place, the great and vital importance of the iron industry in any country. Then he showed how Canada had enormous iron ore resources widely scattered from the Atlantic to the Pacific. But though Canada has many ore beds and mines such as the Helen mine that produce in their natural state ores that are marketable, nevertheless, on the whole most of the ores require beneficiating before the furnace people will purchase them. Up to the present it has been possible to meet the demand with rich ores in the natural state and most of this ore has come from the United States Lake Superior district.

Prof. Graham, after showing in detail the true state of affairs, gave some interesting details as regards beneficiating iron ore and showed a bright future for Canadian ores when ores have to be treated universally. It is known that the tonnage of high grade U. S. ores is rapidly decreasing and consequently the value of U. S. ores is a diminishing quantity whereas relatively with our industry practically at a standstill the value of the Canadian ores is an increasing quantity. As soon as the United States companies have to begin treating their ores and this has already begun on a large scale in the Superior district, then the Canadian companies will be able to compete with their near-ores. Much research work has to be done to stimulate the Canadian iron industry and it is quite apparent that the Canadian government should assist in some measure. Stimulating the iron industry helps many other industries and consequently is a general benefit.

A very hearty vote of thanks was tendered Professor Graham for his excellent address.

Ottawa Branch

F. C. C. Lynch, Associate E.I.C., Secretary-Treasurer.

The Modern Telephone System

At an open meeting of the Branch on the evening of the 24th November, held in the Victoria Museum, N. M. Lash, B.Sc., chief engineer, Bell Telephone Company of Canada, Montreal, gave an interesting and instructive address on "The Complex Nature of a Modern Telephone System". The points covered by the address included:— Switchboards, effect of increasing the number of lines, importance of planning for the future, long distance, complexity of same, replacement of open lines by toll cables, transmission, effect on design, repeaters, etc. The lecture was illustrated with lantern slides and two reels of moving picture films, the first one showing the make-up of a telephone system and the other the progress of telephone installation, training and working of operators, closing with the progress of a call from Montreal to Vancouver. A large audience listened appreciatively to the lecturer and viewed with approval the interesting films.

The E.I.C. and Its Branches

The growing importance and usefulness of local branches of *The Engineering Institute of Canada* as shown by the dependence, more and more being placed on them by municipalities was strongly emphasized in an address delivered at the Ottawa Branch, *Engineering Institute* luncheon by J. M. R. Fairbairn, D.Sc., M.E.I.C., chief engineer of the C.P.R., and President of *The Engineering Institute of Canada.*

In opening, Mr. Fairbairn called attention to a recent speech of Lord Byng of Vimy, delivered in Toronto, in which the Governor General had stated that the future of Canada lay more and more with men of science. Prof. Macallum had also voiced the same sentiments when speaking on China, when he remarked that the future of China depended on the scientific education of its young men. It was common knowledge to the engineer, said Mr. Fairbairn, that the development of past ages was due to scientific attainments. People in other walks of life were beginning to appreciate this.

After tracing the development and growth of *The Engineering Institute of Canada* down to the present, with its 4,500 members and 20 different Branches from coast to coast, Mr. Fairbairn said that with the livened, energetic interest that had been developed, there had been engendered a keen interest by local Branches in civic affairs, that could not help but be of benefit to the public. This stimulation of interest in public affairs, and the improved ability of members of *The Engineering Institute* Branches to discuss civic matters of interest to engineers, were two of the outstanding accomplishments of local Branches, which Mr. Fairbairn considered were of the greatest importance.

A number of local Branches had got in touch with their municipalities and had been asked by them to assist in the solution of problems of interest to the municipalities. Another thing, which the speaker had noticed as a result of formation of Branches, was that engineers were able to get up and express themselves much better. Mr. Fairbairn said he had often been impressed by the ease with which labour men were able to make speeches on any matter, and he thought it was due to the practice they obtained in the lodge rooms. In the same way the Branches of *The Institute* should enable the cultivation of easy speech by the engineers. The latter often excused themselves by saying they were better at doing things than at talking.

The speaker believed that soon the Provincial Governments would be asking the advice and assistance

of *Engineering Institute* Branches in the larger centres, and the day was perhaps not far distant when even the Federal Government could obtain assistance from *The Engineering Institute* headquarters.

Mr. Fairbairn also stressed the importance of professional ethics among engineers, in their relations with one another. After all, these consisted only of the exercise of true courtesy to one another, one great body boosting one another.

If the thought of Lord Byng was to be fulfilled, each engineer must be willing to give his best ungrudgingly, realizing that in their attitude to each other, engineers could do the most good and be of the greatest value in the development of Canada's resources.

Short addresses were made by J. H. Hunter, A.M.E.I.C., Chairman of the Montreal Branch, who said "there was nothing engineers could not accomplish", and by George Mountain, M.E.I.C., chief engineer of the Railway Commission who said he felt sure that *The Engineering Institute* would be invited to give advice to the Federal Government on engineering matters.

The luncheon was presided over by C. P. Edwards, M.E.I.C., Chairman of the Ottawa Branch, who referred to the healthy state of the Ottawa Branch, which had 350 members to-day and $1,600 in the treasury.

Montreal Branch

J. L. Busfield, A.M.E.I.C., Secretary-Treasurer.

Canadian Authors' Week

On Thursday November 24th, in recognition of Canadian Authors' Week, the usual technical paper was abandoned, and the Branch went in for literature with historical and reminiscent talks on Canadian and other authors.

Col. George Ham of the Canadian Pacific Railway was the speaker of the evening, and the Chairman was J. M. R. Fairbairn, M.E.I.C., chief engineer of the C.P.R., President of *The Institute,* who briefly introduced Col. Ham.

Col. Ham's address was in the nature of a humorous anthology of Canadian authors and authoresses during the past half century, with whom he had been personally connected. He began many years back with reminiscences of D'Arcy McGee, whom he eulogized as one of the most brilliant speakers and writers Canada has ever known.

From this, Col. Ham proceeded to some sketchy reminiscences of his intimacy with Mark Twain and his personal associations with such writers as Robert Service, Hon. Frank Oliver, "Jack" Cameron the "Kahn", well known for many years as a newspaper and magazine writer, Augustus Bridle, accused of writing "The Masks of Ottawa"; Col. George T. Dennison of Toronto; "Billy" Moore of the Canadian Northern, who wrote "The Clash"; Hector Charlesworth of Toronto; E. King Dodds, H. F. Gadsby, John Munroe, E. W. Thompson and other Ottawa press gallery writers; Wilfrid Campbell, Bliss Carman, Col. E. J. Chambers, Irvin Cobb, Professor Stephen Leacock, Dr. Drummond and many others.

"But make no mistake" said Col. Ham, "we have good writers in Montreal, most of whom it has been my privilege to know. Such men as Cy. Warman, John Murray Gibbon, Hector Garneau, W. D. Lighthall, Frank L. Packard, George Iles, B. K. Sandwell, William Hunt, Arthur Dansereau, John Reid and Martin Griffin, whose works for so many years adorned The Montreal Gazette, and R. S. White who today yields so trenchant a pen on that journal."

Turning to the women writers of Canada he had known, Col. Ham said there was quite a bevy of them, from "Kit" of the Toronto Mail and Empire; "Françoise" of Montreal; Mrs. Fenwick Williams; "Janey Canuck", Nellie McClung and others.

During the evening a number of recitations from the works of Dr. Drummond and Robert Service were given by Messrs. J. Bevan Giles, R. Roberts, and C. Godwin.

Montreal Aqueduct

On December 1st, F. Y. Dorrance, A.M.E.I.C., division engineer of the Montreal Water Board presented the second of the series of papers on the Montreal Aqueduct dealing with the engineering features. H. W. Fairlie, A.M.E.I.C., presided.

Einstein's Theory

On December 8th, Professor Lewis T. Rutledge, A.M.E.I.C., of Queen's University, Kingston, gave an interesting lecture on Professor Einstein's Theory of Relativity and Gravitation. Prof. H. M. MacKay, M.E.I.C., presided. Professor Rutledge's address has already been published in the Kingston Branch news, so it will suffice to say that the address was found of absorbing interest.

Annual Meeting, December 15th, 1921

The British Government Commercial Intelligence System.

On December 15th, G. T. Milne, the Senior British Trade Commissioner in Canada and Newfoundland, addressed the Montreal Branch of *The Engineering Institute of Canada,* taking as his subject "The British Government Commercial Intelligence System".

In outlining the origin of this form of government assistance to trade, the lecturer pointed out that, in the days when Britain, as the pioneer industrial country of the world, held, almost without challenge, the position of being practically the only country exporting manufactured goods, and when her customers placed their orders through London merchants, there was not the same need for a government-supported Commercial Intelligence System as nowadays when the manufacturers of the United Kingdom have to meet the competition of highly developed countries, such as the United States and Germany. The speaker also thought that the development of a Commercial Intelligence System by his Government was in line with the modern conception of the relation of the state to the individual. Formerly, he said, the trader exporting to countries overseas considered himself more or less self-sufficient, and while this school has still exponents, its members are diminishing, and experience has shown that even the largest firms of manufacturers

find it to their advantage to consult the Department of Overseas Trade in London with regard to their export trade.

After briefly explaining the organization of the Commercial Intelligence Service, Mr. Milne emphasized that it was not the function of a government department or its overseas officers to secure orders, but rather to indicate where opportunities for doing business occur, and by bringing buyer and seller together. His function as a Trade Commissioner was to supplement existing activities of the ordinary merchant and trader, and in no sense to take their place.

Mr. Milne paid a tribute to the work being done by Canadian Trade Commissioners in different parts of the world which he had visited, adding that Canada had appointed Trade Commissioners before Great Britain had. He considered that the explanation of this was to be found that, in a new industrial community such as Canada, whose traders had not yet established business connections in the world's markets, the most convenient method of investigating possibilities was by means of a Trade Commissioner knowing what his country could export. In countries where Canada is not represented by a Trade Commissioner, Canadian importers and exporters may utilize the services of British Consuls. These services, which are being made use of extensively, do not cost the Canadian taxpayer a single cent.

Before concluding, Mr. Milne referred to the forthcoming Eighth Annual British Industries Fair, which is organized by his Department in London, and mentioned that these Fairs has been instrumental in securing orders for British manufacturers running to millions sterling. Buyers flock to this Fair from all parts of the civilized world, and as showing its extent, Mr. Milne mentioned that the alley-ways in the Fair Building, occupied by exhibitors, extend to some miles in length. Wide publicity for the Fair has been obtained throughout the Dominion, and it is hoped that a large number of buyers representing Canadian importers will visit the Fair.

Time did not permit of more than a passing reference to the Export Credit Scheme devised by the British Government with the view of helping Britain's export trade. Under this scheme twenty-six millions sterling has been ear-marked for this purpose. Although originally devised with the view of assisting in the rehabilitation of Central Europe, the scheme, as now amended, applies to the whole world.

Mr. Milne extended an invitation to the members of *The Institute* to make use of the facilities of the Trade Commissioners' offices in all matters regarding trade with the United Kingdom.

The Annual Meeting was opened with the Chairman, J. H. Hunter, M.E.I.C., presiding, and the Secretary announced the election of the following officers:—

Chairman, J. A. Duchastel de Montrouge, M.E.I.C.

Vice-Chairman, John T. Farmer, M.E.I.C.

Committeemen, R. Bickerdike, M.E.I.C., C. J. DesBaillets, M.E.I.C., P. B. Motley, M.E.I.C.

A brief discussion was held on Branch Finances, and it was decided to ask every Member of the Branch to make a voluntary subscription, not exceeding $5.00 per member in order that the activities of the Branch may be carried on, and also a reserve fund built up.

Following the business session, a musical programme was provided, with Chas. M. McKergow, A.M.E.I.C., acting as master of ceremonies. Messrs. Busfield and Swan contributed vocal numbers, and Mr. Lamontagne gave a cello solo, which was greeted with very hearty applause. Light refreshments were served during the evening.

J. A. Duchastel de Montrouge, M.E.I.C., the new Chairman of the Montreal Branch of *The Institute* was born in New York in 1878, his father being the French Consul at that place. He was educated at Public Schools in Quebec, Amsterdam, Paris, Rheims, and entered the Ecole Polytechnique, (Laval University) in 1897, obtaining the Degree of Bachelor of Applied Science in 1901. For a few years Mr. Duchastel was connected with, first, Phoenix Bridge & Iron Works, the Canadian Pacific Railway, and Messrs. George and Vautelet. In 1906 he became city engineer of Outremont and from 1918 to date he has occupied the position of city engineer and manager of the City of Outremont.

Mr. Duchastel has been very active in *The Engineering Institute of Canada*, becoming a Student Member in 1899, an Associate Member in 1904, and a Member in 1912. He is also known as the president of the Automobile Club of Canada, vice-president of the American Road Builders Association, director and past president of the Canadian Good Roads Association. He is a Member of the Engineers' Club, of the Montreal Board of Trade, and the Chambre de Commerce Française.

John T. Farmer, M.E.I.C., the newly elected Vice-Chairman, was born in Liverpool, England, in 1874. He took the degree of B.Sc. and M.Sc., from Liverpool University in 1894, and was awarded the Exhibition of 1891 Scholarship for research entitling him to study abroad for two years. These years were spent at McGill where he graduated with the degree of M.Sc. in 1897, and later, in 1894, he was awarded the degree of Doctor of Science.

Mr. Farmer spent a number of years in the States with the Crosby Steam Gauge and Valve Company, the Ball and Wood Company of Elizabeth, New Jersey, Watts Campbell Company, Newark, New Jersey, and the Green's Economizer Company of New York, while since 1905 he has been the local Sales Engineer and Representative of a number of engineering firms in Montreal, including Glenfield and Kennedy Limited of Kilmarnock, Drysdale and Company of Glasgow, the Combustion Engineering Corporation of New York, also district manager of Green's Economizer Company of Canada.

Mr. Farmer was awarded the Gzowski Medal of *The Engineering Institute* for his work on impulse water wheels in 1898, and has been consulting engineer connected with a number of hydraulic installations.

C. J. DesBaillets, M.E.I.C., is a native of Geneva, Switzerland, and is a graduate of the University of West Switzerland. He came to Montreal in 1904, since when he has been connected with the Shawinigan Water and Power Company, the Structural Steel Company, the

Canada Paper Company, and the Canadian Westinghouse Company. In 1917 he was appointed manager and chief engineer of public utilities for the Corporation of Sherbrooke. In May 1920, Mr. DesBaillets joined the Montreal Water Board as engineer in charge, and has since that time been intimately connected with the carrying out of the Montreal Aqueduct. He became an Associate Member of *The Engineering Institute* in 1917 and a Member in 1920.

P. B. Motley, M.E.I.C., was born in India in 1871, and obtained his engineering education at the School of Practical Engineering in London, England. He has been continuously in the service of the Canadian Pacific Railway since 1892, commencing as a draughtsman under the late P. A. Peterson, and later occupying position of engineer in charge of bridge construction, assistant engineer in charge of design of bridge renewals, and at the present date, engineer of bridges. Mr. Motley became an Associate Member of *The Engineering Institute* in 1898, and a Member in 1905.

Robert Bickerdike, M.E.I.C., is a graduate of McGill University, and has spent a number of years on Railway construction work, and with the Department of Public Works on hydrographic surveys. From 1908 he was connected with the Transcontinental and Canada Central Railways. From 1912 until this year he was with J. H. Hunter and the Canada Starch Company in various capacities, except during the war. He went overseas with the 87th Battalion and returned with the rank of Lieutenant-Colonel. He was awarded the D.S.O. and Bar. At the present time he is in private practice.

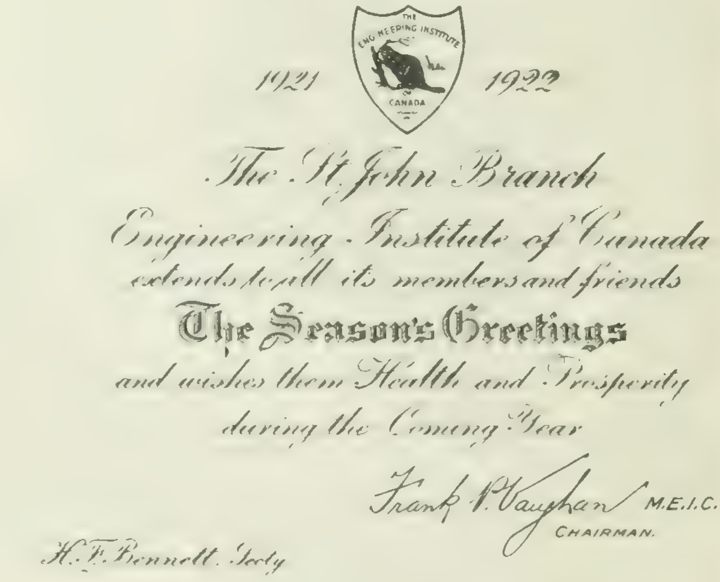
St. John Branch

Harry F. Bennett, A.M.E.I.C., Secretary-Treasurer.

Musquash Power Development

The members of the Branch had a splendid opportunity of seeing the works at the Musquash Power Development on Saturday, Dec. 10th, when they were the guests of the New Brunswick Contracting and Building Co., Ltd., general contractors on the concrete and earthwork sections, at luncheon, and afterwards visiting the various works under the direction of Herbert Phillips, M.E.I.C., managing director of the company, and S. R. Weston, A.M.E.I.C., asst. chief engineer of the Power Commission. The thirty-five members who motored down from the city, thoroughly enjoyed the splendid luncheon, and were impressed with the various works carried out under the direction of C. O. Foss, M.E.I.C., chief engineer of the N. B. Electric Power Commission.

The Musquash River, at the point of development, is 13 miles West of the city of St. John; it has a total watershed above the main dams of about 350 sq. miles, and the turbines are designed for a maximum load of 11,100 H.P. The river itself is small but the numerous lakes in the system, assisted by the increased pondage, will give sufficient water to keep the plant in continuous operation. The water is carried to the power house by an 8-foot wood stave pipe, 7,400 feet long from the main dam on the West Branch, and by a 10-foot wood stave pipe, 3,000 feet long from the main dam on the East Branch, the static head in the former being 128.5 feet and in the later, 103.5 ft.



St. John Branch Christmas Card.

The main dams are of concrete, with earth sections with a concrete core wall. Smaller earth dams are constructed to retain the flowage. On the upper stretches of the river, timber and earth dams have been constructed to increase the storage capacities of the larger lakes. The two intake houses and the power house are of concrete construction, the power house being located at the head of tide water. The turbines consist of two vertical turbines of 3,670 H.P. and one of 3,760 H.P., the generators consist of three 2,900 K.V.A. units.

The power will be delivered at a sub-station on the outskirts of the city of St. John. Steel towers have been erected on concrete foundations to carry the aluminum transmission cables, the longer spans of the cable are steel reinforced.

The first field work on this project was done in July 1920, the first contract let Nov. 9th, 1920, and at present, 95% of the work is completed. Surveys for a transmission line are now being made to Moncton, 90 miles east of St. John.

The contractors for the various works are as follows:—

Earthwork and concrete:—The New Brunswick Contracting and Building Co., Ltd.

Wood stave pipe line:—The Pacific Coast Pipe Co.

Hydraulic installations:—S. Morgan Smith Co.

Electric installations:—The Can. Gen. Electric Co.

Transmission line—clearing right of way:—The Maritime Construction Co.

Towers and erection:—The Canadian Bridge Co.

The regular monthly meeting of the Branch was held on Dec. 15th. A resolution was adopted endorsing the proposed meeting of the Branch Secretaries in January.

The Chairman, F. P. Vaughan, M.E.I.C., explained to the meeting that the Mayor of St. John had asked three members of *The Institute*, Messrs. C. C. Kirby, M.E.I.C., W. G. Chace, M.E.I.C., and G. G. Hare, M.E.I.C., to report on the distribution of the power available from Musquash. Their report had been published and considerable discussion had taken place. He felt that it was up to the city to find a market for the power which had been brought to our doors by the Power Commission and was offered to the city at 1.2 cents per K.W.H.

W. G. Chace, M.E.I.C., then addressed the meeting and explained the various options which offered for the disposal of this available power. He explained, that, with the exception of the several large users, the N. B. Power Company was supplying the city's electricity, as well as gas, and operating the electric railway. The charges for power were high, but various audits had shown that the profits were small. The committee, of which he was a member, recommended that the city and power company might unite in a contract with the Power Commission, the energy being purchased for distribution by the company. He felt that this could be done in such a way as to give the citizens the benefit of any economy.

C. O. Foss, M.E.I.C., then explained the policy of the Power Commission in the matter. They were willing to sell their power at cost, the 1.2 cents per K.W.H. was a maximum price and if it were possible it would be reduced. The commission had spent considerable money on these projects and were ready to go further in the development of power. They want the power distributed to the advantage of the citizens and prefer selling to Municipalities.

Considerable discussion took place after the addresses. opinions differing as to the best method of distribution. Since this meeting the power question has received considerable attention and is being seriously debated by the citizens at large.

Moncton Branch

M. J. Murphy, A.M.E.I.C., Secretary-Treasurer.

Natural Gas

The regular monthly meeting of Moncton Branch was held in the Supreme Court Chambers, Moncton, Wednesday evening, November 23rd. J. D. McBeath, M.E.I.C., Chairman of the Moncton Branch and asst. city engineer presided. The speaker of the evening was Dr. J. A. L. Henderson of London, England, president of the N.B. Gas and Oilfields, Ltd.

In beginning his address, Dr. Henderson told of the difficulty of classification of natural gases. Bituminous materials are divided into three great classes, pure bitumens, pyro-bitumens and artificial bitumens. In the pure bitumens are included all from gaseous to solid. Besides what is known commercially as "natural gas" i.e. petroleum gas, there are other gases in nature as for example natural coal gas and gases associated with igneous rocks in volcanic areas and steam.

Natural gas is used for domestic purposes for light, and for heating purposes, cooking, hot water and individual stoves, but should not be used for general house heating. It is used for industrial purposes for gas engines and boilers. It is now considered unwise from the national standpoint and for the consumer's own benefit to use it for heating of houses, on account of waste. Use under boilers is extremely wasteful. Four to five times the amount of gas is consumed to get the same relative efficiency. For smelting, baking bricks and tiles, and for the production of lamp black it should not be used, although in the United States 51,000,000 lbs. of lamp black was produced in 1920 from natural gas, chiefly in districts where the gas is so distant it cannot be used for any other purpose.

Speaking of the waste of natural gas, Dr. Henderson stated that it is estimated that in 1920 in the United States the waste was at the rate of 800 billion cubic feet per annum the equivalent of 20 million tons of high grade gasoline. This waste is incurred in production, distribution and in mis use.

Figures for 1911 show that 11,132,642 acres are held in the United States for exploitation purposes while 1918 figures give over 14 million acres. The acreage held for petroleum exploitations purposes in 1911 was over 8 million acres. On an equivalent basis of gasoline at 20 cents per gallon the natural gas would exceed the petroleum in value by 40 to 50 per cent.

The relative value of natural gas to a nation as compared with petroleum from the standpoint of value in quantity and area is equal if it does not exceed that of petroleum. Its drawback is that it can be used at present only in the country in which it is found. Pipe lines of 400 to 500 miles in length are probably the extreme limit of distance to which it can be conveyed. Natural gas is at the mercy of the country within which it is found. The community should interest itself in controlling the use of it not only for its own benefit but also for the use of posterity.

Over 95 per cent. of the known natural gas is produced in the United States. Canada comes next with 2 per cent; Russia, Galicia, Roumania and Italy follow consecutively. Natural gas is chiefly found in sedimentary rock mostly sandstone and limestone. It has been accumulated from the earliest time to now from the carboniferous rock period downwards. The largest initial flows of gas were found in Louisiana running from 40 to 75 million cubic feet and in California where a flow of 100 million a feet was struck, the pressures varying from 1500 to 2000 lbs. per square inch. The deepest well from a productive standpoint is the Liganier well near Pittsburg. It is over 6000 feet deep, averages 500,000 cubic feet and the pressure is too great to measure. The deepest well in the world is the Lake well in West Virginia, sunk in 1919 at a cost of $150,000. This went to a depth of 7,579 feet at which depth a temperature of 168 degrees Fahrenheit was encountered. This well failed to produce profitable gas.

After tracing briefly the early history of natural gas during which he stated that the Chinese and Phoenicians and Fire-worshipers along the Caspian Sea and others cognizant of it, the speaker said the present commercial development dated back only about 40 years. Canadian production commercially began in 1890 with a value of

$150,000. In 1910 the value had increased to $1,491,249. Since then there has been large expansion in Alberta and New Brunswick. One company alone in Alberta sold almost four billion cu. ft. yearly over more than 8 years.

In speaking of our Canadian fields in particular, Dr. Henderson dwelt on the need for conservation. The average life of a gas well is ten years and after the present supply is depleted there is no renewal to the wells. Some of the causes of uncurbed use of it, are too much use for industrial purposes and too low a price.

Dr. Henderson stated he was formerly of the opinion that government control of the natural gas resources was preferable but is now of the opinion, because of danger of depletion of the fields, that private ownership under regulation is better. To replace the 660 billion cubic feet of natural gas used in the United States in 1920 would require an expenditure of $1,200,000,000 for other fuels.

In closing, the chairman tendered Dr. Henderson a hearty vote of thanks for the clear and concise manner in which he presented such an excellent address on so intricate a subject.

Cape Breton Branch

Kenneth G. Cameron, A.M.E.I.C., Secretary-Treasurer.

Low Carbon Steels

A regular monthly meeting was held December 9th, in the Branch rooms at Sydney, there being about thirty members present when the meeting was called to order by the Chairman, C. M. Odell, M.E.I.C. The business of the evening was a paper by W. S. Wilson, A.M.E.I.C., on "Some interesting features relative to the properties, heat-treatment, and working of low carbon steels".

Mr. Wilson in opening, emphasized the fact that the breadth of his subject was such that he could only select a few of the more interesting characteristics, dealing with these from the viewpoint of our local problems, rather than from a highly technical attitude.

We might consider, he said, that modern civilization had its beginning with the intensive manufacture of steel, and it is certain that all our scientific discoveries can only be turned to public service and profit through the development of materials of engineering which will stand up to test,—we can see therefore the necessity of thoroughly acquainting ourselves with the properties and possibilities of those materials we have.

Dealing briefly with the microstructure resulting from the natural cooling of molten steel, Mr. Wilson illustrated the different characteristics of the constituents by an excellent microphotograph,—1000 diam. magnification,—of a piece of steel the surface of which had been scratched by a needle, the varying width and depth of the scratch showing clearly the difference between the soft and hard parts.

Mr. Wilson then gave some details of a recent discovery, in which the treatment of microscopic specimens by a new reagent deposits a thin film of copper on the purer steel as opposed to those portions containing segregated phosphorus, thus developing a pattern corresponding to the distribution of the phosphoric areas. Successive illustrations of an ingot, bloom, billet and bar treated in this manner, showed very clearly the effects of rolling and work done upon the steel. By means of this method of microscopic examination of steel, it is also possible to determine whether a failure is due to bad design or defective material.

An illustration of an ingot in which pieces of high manganese steel had been embedded regularly, and which was then drawn down in a hydraulic press, showed the irregularities resulting from this type of working as compared with that of a rolling mill.

Mr. Wilson then followed through the changes known to take place during the heating of steel, and the widely differing results obtainable by varying the heat-treatment, and dealt in particular with the results which might be expected from the recent installation by the Dominion Iron and Steel Co. of a rail bloom reheating furnace. He also emphasized the fact that properly heat treated carbon steels were taking the place of the more expensive alloy steels which came into use so largely a few years ago. The following table is an illustration of what we can do with our own home product, properly heat treated:—

	.8% carbon Steel, heat treated.	1.11% vanadium Steel, as rolled.
Elastic limit........	139,000 lbs.	121,000 lbs.
Breaking stress......	178,000 lbs.	172,500 lbs.
Elongation in 2"....	14%	10%
Reduction in area...	43%	17.6%

At the close of the paper considerable discussion took place, the subject being of strong local interest,—and at its conclusion, Mr. Wilson was accorded a very hearty vote of thanks.

Halifax Branch

O. S. Cox, A.M.E.I.C., Secretary-Treasurer.

Town Planning

The regular monthly meeting of the Branch was held at the Green Lantern, December 19th. Attendance, 42. C. E. W. Dodwell, M.E.I.C., Chairman of the Branch, presiding. Supper was served at 6.30 P.M., after which the meeting was called to order. H. W. Johnson then presented a very valuable paper on Town Planning. Mr. Johnson explained that the subject was too large to attempt to cover it fully in one evening. He touched on several phases of the subject, however, and many interesting features were brought out.

The following is an incomplete resumé of some of the points made by Mr. Johnson:—

A Town Planning Scheme is a means of providing for convenience, safety, service, contentment, health and progress. Intelligent planning saves the expenditure of large sums of money in spasmodic and costly attempts to keep pace with the growth of a city. Growth means expansion, change and new conditions. A town and its urban areas should be planned to provide for such future expansion. Transportation must be rapid and convenient and street systems must be provided to give a maximum

of ease and rapidity of movement. Street requirements are constantly changing, since growth brings increased traffic with increased freight tonnage. The rectangular layout of streets is the most common and has the advantage of economy and simplicity but has the disadvantage that the best grades cannot be obtained and it does not admit light and air freely. The diagonal or radiating system gives convenient, quick access from distant points to centre of the city but has the disadvantage of causing oblique street angles and loss of area.

Town Planning is comparatively modern and the majority of cities have grown up without any preconceived plan or layout and are unable to adequately cope with rapid growth and changing conditions. Many cities have adopted town planning in later years and while not getting the full benefit possible, are able to correct many existing evils and to provide for further growth and expansion. Halifax and Baltimore are examples of cities which have taken advantage of great civic disasters to introduce town planning for rebuilding devastated areas. In the case of Halifax, the area devastated by the explosion in 1917, which previously had a rectangular system of narrow streets, with grades of from 13 to 20%, has been rebuilt with wide streets, boulevards, parks and a modern aesthetic type of buildings. The maximum street grade in the rebuilt district is 5%.

A zoning law is a power whereby a city controls the character, use, height, location, etc., of its buildings. It provides districts for offensive industries; it segregates business and residential areas, regulates the location of homes at convenient distances from work, allows for a proper and sanitary admission of light and air and tends to make for better health, greater happiness and for the general betterment of the whole community. From the restrictions provided by a zoning law, values become stabilized and in consequence, investments give a more stable and more certain return.

The paper was followed by a good discussion by various members and guests of the Branch.

Mr. Murdoch extended an invitation to the Branch to attend the regular monthly meeting of the N. S. Electrical Association which was then in session in the adjoining room. Our meeting adjourned at 9.00 P.M., and gratefully accepted this kind invitation. A very pleasant hour was spent with the Electrical Association, who provided a very interesting programme of music and motion pictures.

Halifax Branch

Programme for the Season 1921-1922

October

Reconstruction in France after the War.
Prof. F. H. Sexton,
Principal of N.S. Technical College.

November

Tramway Engineering.
By I. P. MacNab, M.E.I.C.

December

Town Planning.
H. W. Johnson,
Assistant City Engineer.

January

Some Problems met with in Local Building Construction.
C. St. J. Wilson, A.M.E.I.C.

February

A Lump of Coal.
K. L. Dawson, A.M.E.I.C.

March

Engineering Underground in France.
R. R. Murray, A.M.E.I.C.

April

Some Problems met with in Surveying.
H. B. Pickings, A.M.E.I.C.

May

The Work of the Municipal Engineer.
F. W. W. Doane, M.E.I.C.

In addition to the above, there are several interesting papers in view, with uncertain dates.

Members will receive timely notice of each meeting.

Town Planning Notes and Comments

H. L. Seymour, A.M.E.I.C.

NOTE: — *In order to make this column of wide interest to members of The Institute, personals and items of town planning interest will be appreciated. Address: H. L. Seymour, A.M.E.I.C., 40 Jarvis Street, Toronto.*

Short Course in Civics and Town Planning

The two weeks Extension Course in Civics and Town Planning at Toronto University during January is an interesting experiment. It presents several unique features, that might well be reviewed at some length in this column.

The course is open to the public as well as students, at a purely nominal fee. It is expected to fill, in some measure at least, a long felt want. Some day, and probably some day soon, there will be full and regular town planning courses in our Canadian Universities. The next generation of town planners will be trained and equipped as our engineers and architects now are, at our Universities. But at present there are many interested in the subject of town planning and municipal development, who wish to have their reading intelligently directed and stimulated. To those technically interested in town planning, the course offers an opportunity for mutual betterment.

The course as announced is to consist principally of lectures and discussions and if time permits of work on actual problems. Evening discussions of actual or theoretical problems may be arranged, if the class so desires. Saturday afternoons may be utilized for visits to points of interest. Those from localities outside Toronto have been invited to bring maps or plans of their district, together with particulars of the circumstances surrounding any problem which happens to be interesting them. It is hoped that in this way the actuality of instruction and discussion may be augmented

and solutions of real problems, in some cases, found.

The lectures have been divided under four general headings: — Economic, Sociological, Technical and Administrative, and may be briefly described as follows:—

Economic

The economic aspects of urban growth and concentration with and without civic control, in relation to housing, land, agricultural and industrial development, taxation, transportation and finance.

Costs and values in municipal development; examples drawn from original investigations in Canada.

Results of the Ontario Housing Loan Policy.

Sociological

The relation of overcrowding and underhealth; reactions of housing environment on characted and physique, and mortality rates.

Education and recreation. The interaction of these and their place On the plan, whether urban or rural.

The organized suburb and the satellite town, with examples drawn from present-day effort and achievement in England.

The larger aspects and ideals of civics as the gathering of knowledge on which a wide plan, town plan, country plan, for the improvement of the quality of human living can be based.

The study of one particular community in Ontario. Its growth and prospects. Its delimiting conditions and its opportunities. The lessons of such a study.

The History of Toronto as to maps and plans.

Technical

Maps and plans and map reading. Canadian maps. Varieties of notation in plans of towns.

Roads and pavements. Location, grades and various methods of construction.

Sewers and drains — How the work under ground, without which the modern city would be uninhabitable for modern people, is planned and built and how it functions. Its effect on the health of communities, with statistics compiled from Canadian examples. The ways in which the drain and sewer plan guides or should guide the general plan of a small subdivision or a great city.

The original survey and its effect on the town plan.

Planning for sunlight and for other meteorological conditions.

Zoning, or the segregation of the various districts of a town. The Idea. Examples at work.

Transport to the city and transport within. Its means, problems and effects.

City parks, gardens and open spaces. The proper utilization of ravines and bad ground. Treatments for boulevard and front lawns and the kind of trees suitable to these.

An account of the Provincial Government's scheme for Kapuskasing. The climatic, geographical, social, industrial and incidental limitations of the problem and its solution.

Varieties of street sections. Widths and heights. Boulevard — terraced street, etc.

The placing of public buildings and the civic centre idea.

Where the architect comes in. Examples great and small of civic architecture and the effects attainable by the right architectural treatment of buildings including even those not under civic control.

Administrative

Civic government under the four headings:

(a) What is a municipality?

(b) The mayor, city council plan.

(c) The commission form of government.

(d) The council or commission-manager plan.

With a discussion of the effects and defects of the forms of civic government used in North America.

The law in Ontario to-day regarding town planning and housing.

Ways and means; or how even under existing laws, town planners' ideas may be put into effect.

The classes will be welcomed and addressed by Sir Robert Falconer, president of the University, Brigadier-General C. H. Mitchell, M.E.I.C., dean of the Faculty of Applied Science and Engineering, and J. P. Hynes, A.M.E.I.C., president of the Ontario Town Planning and Housing Association.

Prof. Adrian Berrington, Department of Architecture, who has been responsible for the preparation of the course, each day will lead the classes in general discussion of the day's work. Among the seventeen lecturers, University professors and external authorities, there are several corporate members of the E.I.C., from Ottawa and Toronto.

It is hoped to present as part of this column in succeeding months, a review of the lectures.

Preliminary Notice

of Applications for Admission and for Transfer

21st December, 1921

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate member a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility o each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in January, 1922.

FRASER S. KEITH, Secretary.

*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option, Railway, Municipal, Hydraulic, Mechanical, Mining or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidat. has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years oe age, and must have been engaged in some branch of engineering for at least four yearsf This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects, Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits cientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

> The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

AINSLIE—CHARLES MILLS, of Poona, India. Born at Mintlaw, Aberdeenshire, Scotland, April 4th, 1886; Assoc. Member, Aberdeen Assn. Civil Engrs.; Educ., C.E. course, Gordon Tech. Coll., Aberdeen, 1st class cert., 1902-08, ap'ticeship as civil engr., Great North of Scotland Rly., Aberdeen, 1902-07, and from 1907-11, asst. engr. in charge of extension and improvements of rly.; 1911-14, res. engr., 3 Sections, Pembroke North Bay. Ont., C.N.R; 1914-19, Major, Royal Engin., repair, constrn. & mtce. of mil. rlys. in France and Belgium. Awarded M.C.; 1919 to date, Garrison Engr., Military Works Service, India, in charge of constrn. etc., of military cantonments, fortifications, bldgs., streets, water supply etc.

References: A. F. Stewart, H. K. Wicksteed, G. P. MacLaren, G. L. Ridout, H. S. Tawse, H. W. D. Armstrong, A. H. Greenlees.

ALLEN—GEORGE WILLARD GORDON, of 51 Chebucto Road, Halifax, N.S. Born at Yarmouth, N.S. May 30th, 1895; Educ., Diploma, short course, N.S. Tech. Coll.; 1914-15, timekeeper, Halifax Ocean Terminals; 1917-19, overseas; 1919, location party, C.N.R.; 1920, track topography, Halifax & North Western; At present asst. dftsman., Land Survey Dept., C.N.R. Maritime District.

Reference: A. C. Brown, J. W. Roland, E. F. Handy, S. B. Wass, D. F. MacIsaac, J. H. Congdon.

ANGUS—JOHN VICKERS, of 298 St. James Street, Montreal, Que. Born at Stoockfield-on-Tyne, England, March 29th. 1889; Educ., 1905-07, Sheffield Univ. 1907-10, Durham Univ. 1916, best class, Board of Trade, London; 1905-07, ap'ticeship, Messrs, T. F. Camwell & Sons Ltd., Gen. Elect'l., Contractors; 1907-11, Wallsend Slipway & Engr'g. Co. Ltd., Shipbldrs. & Engrs.; 1911-14, asst. supt. engr., Ellerman Lines Ltd.; 1914-19, engr. officer in charge of machinery afloat in naval reserve and merchant services; 1919-20, efficiency engr., Manchester Steam Users Assn.; At present, asst. gen. magr., Armstrong Whitworth of Canada, Ltd.

References: H. Holgate, J. H. Hunter, R. Bickerdike, A. Surveyer, C. W. Allen, R. J. Beausoleil, G. A. Gaherty.

BARNUM—JOHN BAYLOR, of 472 LaSalle Road, Verdun, Que. Born at Birmingham, Ala., Dec. 29th, 1889; Educ., I.C.S. Diploma, surveying & mapping. 1st and 3rd year field work, McGill Univ., 1911 (Jan.-Apr.), on subdivn., work in Sask. with J. Pierce, O,L,S., D,L,S; 1911-15 Farming in Sask.; 1917-19, overseas; 1919(oct. and Nov.); instr'man., sewer constrn., W.S. & R.S. Lea; 1919-20, dftsman., Nor. Elec. Co. and G.T. Arbitration Board; 1920-21, asst. engr., Riordon Co. Ltd.; 1921 (May-Oct.), instr'man. with G. H. Blanchet, D.L.S., Mackenzie River Traverse; Not employed at present.

References: R. S. Lea, A. B. McEwen, J. Ewing, W. A. Grafftey, G. R. Heckle, A. R. Henry, G. R. MacLeod.

BOWNESS—FRANK, of 302 Boswell Avenue, Peterborough, Ont. Born at Manchester, England, Oct. 17th, 1884; Educ., 4 years student's mech. engr'g. course; 10 years elect'l. & mech. dftsman.; 5 years to date, asst. foreman, dfting. dept., Can. Gen. Elec. Co., Peterborough, Ont.

References: L. De W. Magie, B. L. Barns, D. L. McLaren, E. R. Shirley, A. B. Gates, P. L. Allison, G. R. Langley, V. S. Foster.

BRADLEY—THOMAS BRISTOL, of Box 1728, Welland, Ont. Born at Dunkirk, N.Y., Jan. 25th, 1895; Educ., Matric., St. Andrew's College; 2½ years, mtce. dept., C.P.R.; 2 years rodman, 2 years instr'man, Welland Ship Canal; 2 years overseas with R.F.C.; At present instr'man., Section No. 5, Welland Ship Canal.

References: E. P. Johnson, H. W. Bruce, R. C. Morgan, E. P. McAuliffe, H. C. Maguire, E. S. Turner.

BURPEE—FREDERICK DENILLE, of 246 Albert Street, Ottawa, Ont. Born at Ottawa, Ont., April 25th, 1876; At present mgr., Ottawa Electric Rly., with supervision over all depts.

References: G. G. Gale, C. P. Edwards, J. E. Brown, J. Murphy, A. A. Dion, P. Sherrin.

CRUMP—HENRY NEVILL, of Regina, Sask. Born at Corfe, Taunton, England, June 17th, 1885; Educ., premium ap'tice, London & North Western Rly., Crewe, 1904-07; 1908-09, engr'g. inspr., main sewer constrn., London County Council; 1912-13, rodman, C.P.R., Calgary, Alta.; 1917-19, overseas. Lieut., Can. Rly. Troops; July 1921 to date, instr'man., Dept. Highways, Sask. Prov. Govt.

References: H. S. Carpenter, H. R. MacKenzie, C. K. Brown, G. R. Taylor, G. P. MacLaren, F. L. C. Bond, E. P. Bowden.

CURTIS—CLAUDE C., of 65 Whitney Ave., Sydney, N.S. Born at Battle Creek, Mich., March 27th, 1883; Educ., B.S. (Mech.Engr.) Univ. of Mich. 1907; 1907, inspecting engr. on constrn. work for Stone & Webster, Engr'g. Corpn.; 1907-12, served successively as asst. light & Power supt., light & power supt., gen. supt. and mgr., Ponce Railway & Light Co., Ponce, Porto Rico; 1912-13, private secretary to Messrs. Russel Robb and H. G. Bradlee, members of firm Stone & Webster, Boston, Mass.; 1913-15, supt. Houghton County Eletric Light Co., Houghton, Mich., 1915-18, supt., light & power dept., El Paso Rly. Co., El Paso, Texas; Jan. 1918 to date, mgr., Cape Breaton Electric C. Ltd., Sydney, N.S.

References: G. D. Macdougall, A. P. Theuerkauf, A. W. McMaster, H. Longley, K. H. Marsh, R. J. Fisher, C. M. Smyth.

CUSHING—ARTHUR GIBB, of 555 Mount Pleasant Ave., Westmount, Que. Born at Montreal, Feb. 6th, 1890; Educ., B.Sc., McGill Univ., 1912; 1909-10 and 1912-14 [illegible] years, with Illinois Traction System, about six mos. each in carshops, dfting office, substation dept., powerhouse constrn. work, gas mfg. plant and gas distribution dept.; Nov. 1919 to date, asst. supt., gas distribution dept., Montreal Light Heat & Power Co.

References: E. J. Turley, L. A. Kenyon, G. W. Shearer, J. R. Donald, J. C. Stewart, R. M. Wilson.

DAWES—ALBERT, of Sydney Mines, N.S. Born at Sheffield, England, April 6th, 1875; Educ., mech., civil and elect'l. engr'g., Sheffield Tech. School, 1892-95. Cert. (Honours) in engr'g., City & Guilds of London, Institute. 1895-98, ap'ticeship in shops of Earles Shipbldg. & Engr'g. Co., Hull, England; 1898-1900, with Bailey & Leetham Co., Engrs. & Ship Owners, Hull, England, 18 mos. at sea as 3rd engr. Holder of 2nd class engr's .Board of Trade Cert.; 1900-05, 1 yr. shops, 4 years engr's. office, Vickers Sons & Maxim Ltd., Sheffield; 1905-07, dftsman., Cammell Laird Co., Sheffield; 1907-10, designer of bridges, steel structures & colliery equipment, Markham & Co., Chesterfiled; 1910-11, dftsman., Dom. Iron & Steel Co., Sydney, N.S.; 1911-15, chief dftsman. and 1915 to date, divn'l. engr., Nova Scotia Steel & Coal Co. Ltd., Sydney Mines.

References: T. J. Brown, D. H. McDougall, C. D. Macdougall, A. P. Theuerkauf, C. M. Odell, J. Purves.

DENNIS—THOMAS CLINTON, of 252 Powell Ave., Ottawa, Ont. Born at O'Leary, P.E.I., Nov. 19th, 1886; Educ., B.Sc. McGill Univ. 1910; D.L.S. 1911; 1910 to date, summers — in charge of field parties for geodetic, boundry & irrig. surveys, winters — offices of the geodetic or boundry survey; At present, geodetic engr., geodetic survey of Canada.

References: N. J. Ogilvie, J. J. McArthur, J. D. Craig, W. M. Tobey, J. W. Menzies, A. M. Grant.

DONALD—ALEXANDER STUART, of Musquash, N.B. Born at Moncton, N.B. Jan. 26th, 1885; Educ., private study; 1904-07, rodman, N.T.C. Rly.; 1907-08, instr'man; 1908-12, res. engr., N.T.C. Rly.; 1912-15, res. engr., Dartmouth — Deans, Rly.; 1915-19, overseas. C.F.A., Major, D.S.O.; At present, res. engr. in charge of concrete and earth dams, etc., N.B. Electric Power Comm.

References: C. O. Foss, L. H. Wheaton, J. D. McBeath, H. Phillips.

DONALD—JOHN CLINTON, of Fernie, B.C. Born at Belleville, Ala., U.S.A. Nov. 16th, 1876; 5 years, dfting., designing & constrn. of rly, elect'l. distribution systems, Boston Elevated Rly.; 2 years, ap'tice in shop and testing depts., General Electric Co.; 1907-09, supt. and elect'l. engr., Southern Light and Traction Co., Natchez, Miss.; 1909-11, constrn. engr., Chattanooga Rly. & Light Co., Chattanooga, Tenn.; 1911-16, gen-supt. & chief engr., Ashville Power & Light Co., Asheville, N.C.; 1916-17, asst. gen. mgr., Ashland (Wis.) Light, Power & Street Rly.Co. & Ironwood & Bessemer (Mich.) Rly. & Power Co.; 1918-19, Capt. and Major, U. S. Army; 1919 to date, gen. mgr. and chief engr., B.C. and Alta. Power Co. Ltd., Fernie, B.C.

References: R. S. Trowsdale, E. A. Cleveland, A. Cummings, E. G. Marriott, G. P. Napier, G. A. Johnson.

EISENHAUER—ERLE E., of Gleichen, Alta. Born at Martins River, N.S., Nov. 13th, 1894; Educ., B.S.A. Univ. of Sask., 1918, B.S. (C. & I.E.), C.A.C., Colorado, U.S.A., 1921; Duty of water investigation for Dom. Govt., in charge of Station at Coaldale, under irrig. branch, dept. of the interior; At present, instructor in irrigation work at the prov. schools of agriculture at Raymond & Gleichen, also irrig.-expert for the two farms in connection with these schools.

References: F. H. Peters, V. M. Meek, G. N. Houston, S. G. Porter, A. R. Greig.

EMMERSON—FRANK HAROLD, of Box 685, St. Catharines, Ont. Born at Peterborough, Ont., March 2nd, 1893; Educ., Peterborough Collegiate Institute. 1910-14, ap'ticeship course in elect'l. dfting., Can. Gen. Elec. Co.; 1914, dftsman., Can. Gen. Elec. Co.; 1915, dftsman, Wm. Hamilton Co. Ltd.; 1916, dftsman., Can. Gen. Elec. Co.; 1917-18, overseas; 1919 to date, dftsman. at present in charge of dfting room at section No. 3, Welland Ship Canal, Thorold, Ont.

References: F. S. Lazier, C. W. West, E. P. Murphy, J. E. Sears, P.P. Westbye, M. B. Maclean.

GRAY—EARL ALEXANDER, 9 Edward Street, London, Ont. Born at Petrolia, Ont., Jan. 24th, 1892; 1907-09, student and asst. with C. A. Jones, O.L.S., and C.E., Petrolia, Ont.; 1910-12, dftsman. with various firms in U.S.A. and res. engr's. office C.P.R., London, Ont.; 1913-15, asst. engr., Public Utilities Comm. London, Ont.; 1915-19, overseas; Aug. 1919 to date, asst. engr., Public Utilities Comm., London, Ont.

References: F. W. Cooper, F. B. Tapley, F. M. Brickenden, W. E. Stephens, J. R. Rostron.

IBBETSON—NEIL ROBERTS, of 104 Hess St., North, Hamilton, Ont. Born at Hamilton, Ont., July 5th, 1900; Educ., Hamilton Tech. School; 1916-18, dftsman., Hamilton Bridge Co., Hamilton; 1918-19, surveying dfting. etc., Dom. Steel Products Co., Brantford, Ont.; 1919 (Jan.-Mar.), dftsman., Hall and Co. Pipe Machinery, Brantford; 1919 (Mar.-Sept.), estimator and dftsman., A. Cromar, Brantford; 1919-20, quantity surveyer, etc., for Archibald & Holmes, Toronto; 1920-21, asst. supt. [illegible] Canadian Cottons Bldg., Hamilton; 1921 (Jan.-May), estimator and secretary, Bowser Constrn. Co., Hamilton; At present, [illegible] for Barber, Wynne Roberts & Seymour, Toronto. Also engr. in charge of labour & constrn., of a reinforced concrete bldg., [illegible] storage bldg. for Growers Cold Storage & Ice Co., Grimsby, Ont., Mr. K. Percy Sims, Architect, Montreal.

References: J. A. McFarlane, C. H. Marrs, C. J. Madgett, A. R. Macpherson, W. E. Janney, J. Erskine, F. T. Nichol, A. R. Holmes.

JACQUES—GILBERT J. P., of 3 Ouelette Ave., Windsor, Ont. Born at Windsor, Ont., Oct. 22nd, 1887; Architecture, Pennsylvania Univ., 1909; Designing reinforced concrete for Trussed Concrete Co. Ltd., Walkerville, Ont.; Fifteen years to date, private practice, architect and engr., Windsor, Ont.

References: M. E. Brian, J. J. Newman, A. J. Riddell, W. J. Fletcher, C. R. McColl

JOHNSTON—JOHN A. C., of Box 596, Glace Bay, N.S. Born at Glace Bay N.S., April 23rd, 1890; Educ., mech. engr'g., I.C.S.; 1907-12, ap'ticeship, gen. mach. shops, Dom. Coal Co. and Sydney and Louisburg Rly Co.; 1912 to date, dftsman., Dom. Coal Co. Ltd. (1915-21, instructor in mech. drawing and mach. design, evening tech classes, N.S. Coal Mining Schools, Glace Bay, N.S.)

References: K. H. Marsh, H. C. Chipman, A. L. Hay, D. Morrison, J. R. Morrison K. G. Cameron, S. C. Mifflen.

JONES—LOUIS ELGIN, of 587 Bathurst Street, Toronto, Ont. Born at St. Thomas, Ont., Nov. 2nd, 1877; Educ., B.A. Univ. of Toronto, 1900. Grad. S.P.S. Univ. of Toronto, 1911; 1908-11 (Summers), dfting & instrumentwork on water powers & general surveying in northern Ontario; 1911-12, asst.engr., roadway dept., City of Vancouver; 1912-13, engr. in charge of estimating, purchasing, planning of work, B. C. Granitoid Co. Ltd.; 1913-14, engr. in charge of estimates, tenders on contracts, purchasing, planning of constrn. work, Jones Cornell Constrn. Co. Ltd., and Marsh Hutton Powers Co. Ltd., allied companies; 1914-19, overseas. Lt.-Col., C.M.G., D.S.O. and Bar. Mentioned in despatches 4 times; At present, asst. engr., Dept. of Public Highways, Prov. of Ontario.

References: W. A. McLean, G. Hogarth, H. T. Routly, A. E. Jupp, G. F. Hanning.

LARD—ERNEST ELLIS, of Newchwang, North China. Born at Ladner, B.C., Mar. 2nd, 1893; Educ., 1913-15, McGill Univ.; 1910-13, rodman & instr'man., C.N.R.; 1915-19, Lieut., Royal Engrs.; 1919-20, instr'man., Can. Govt. Rlys.; At present, asst. engr., Lower Lioo River Conservancy, Newchwang, North China.

References: W. G. Swan, H. K. Dutcher, W. K. Gwyer.

MACNEIL—HECTOR, of Saskatoon, Sask. Born at Washabuck, N.S., May 1st, 1880; Educ., B.Sc., Mass. Inst. of Tech., 1901; 1901-02, levelman surveys and instr'man. constrn., Cape Breton Rly.; 1902-03, instr'man., D.I. &. S.; 1903-04, transitman and asst. chief of party and 1905-11, chief of party and div. engr., T.C.Rly.; 1911-13, chief of party, G.T.P. and senior asst., P.W.D.; 1913-14, mtce. of way, G.T.P.; 1915-19, asst.engr., valuation, C.N.R. and G.T.P. and track lifting and relaying for overseas shipment; 1919 to date, dist. engr's. office, C.N.R., Saskatoon.

References: R. W. Leonard, F. D. Anthony, D. H. McDougall, G. Grant, G. C. Dunn, E. P. Goodwin, J. N. deStein, A. Macgillivray.

MACKENZIE—KENNETH, of Winnipeg, Man. Born at Malagash, N.S., Jan. 3rd, 1894; Educ., B.Sc., (E.E.) N.S. Tech Coll. 1921; 1912-13, dftsman., and instrumentwork on survey, C.N.R., Alta.; 1921 (June-Sept.), supervision of concrete road construction, New Glasgow, N.S.; At present on eng'r staff, publicity dept., Canada Cement Co., Winnipeg Man

References: F. R. Faulkner, I. P. MacNab, W. G. Hardy, H. S. VanScoyoc, H. W. Mahon.

MACLEAN—DUNCAN ANGUS, of Sydney, N.S. Born at North Sydney, N.S., Oct 26th, 1883; Educ., I.C.S. and private study; 1903, rodman, Intercolonial Rly.; 1905-07, rodman, leveller, etc., T.C.Rly.; 1907-10, inspr. ofpiling, concrete and material, T.C.Rly.; 1910-11, asst. supt. of bridge erection, W. P. McNeil Co.; 1912-13, asst. constrn. engr., Dom. Iron & Steel Co., Sydney, N.S.; 1914, town engr., Amherst, N.S.; 1915-17, highway engr., Cape Breton and Victoria Counties; 1917-20, asst. contrn. engr., and 1920-21, constrn. engr., Dom. Iron & Steel Co., Sydney, N.S.

References: H. Longley, A. W. McMaster, D. F. MacIsaac, K. G. Cameron, A. P. Theuerkauf.

MASSICOTTE—JOSEPH OCTAVE, of 1362 St. Valier St., Montreal, Que. Born at Ste Genevieve, Que., Sept. 17th, 1886; Educ., Montreal Technical School, 8 years gen. elect'l. contractor; 5 years to date, prof. of technology, in charge of elect'l. test and laboratory, Montreal Technical School.

References: W. J. Francis, F. B. Brown, A. Surveyer, J. A. Lefebvre.

MAYBEE—ENOS, of 495 Gilmour Street, Peterborough, Ont. Born at Peterborough, Ont., in 1881; 20 years dfting., 10 years to date, foreman dfting dept., Can. Gen. Elec. Co., Peterborough, Ont.

References: A. B. Gates, B. L. Barns, E. R. Shirley, J. A. G. Goulet, V. S. Foster, L. De W. Magie.

MEWBURN—JOHN STEWART, of R.R. No. 3, Niagara Falls, Ont. Born at Stamford, Ont., Sept. 6th, 1895; 1912. rodman, Algoma Central & Hudson Bay Rly.; 1913-14, rodman with J. C. Street, O.L.S.; 1914-19, overseas. Lieut., C.F.A.; 1919 to date, 4 mos. rodman, 2 yrs. and 8 mos. instr'man., Welland Ship Canal.

References: W. H. Sullivan, J. C. Street, E. P. Johnson, R. C. Morgan, M. B. Maclean, O. W. Ross.

MITCHELL—JOHN CLARENCE, [illegible] Mill St., London, Ont. Born at Kingston, Ont., Sept. 12th, 1894; Educ., B. A. Western Univ., F., 1913. B.A.Sc., Univ. Toronto, 1921; 1912 [illegible] [illegible] Winchester [illegible] McCormick Mfg. Co. [illegible] [illegible] [illegible] [illegible] Ont.; 3 mos. with Webster Constrn. Co., London, Ont.; 1915-19, overseas. C.F.A. Awarded M.C.; At present, [illegible] Webster Constrn. Co. Ltd., London, Ont.

References: J. A. Bell, F. A. Bell, H. B. R. Craig, G. C. Wright, W. J. Forbes-Mitchell, C. R. Young.

MUSGRAVE—WILLIAM [illegible], of Chippawa, Ont. Born at Halifax, N.S., Dec. 23rd, 1890; Educ., B.Sc., Queen's Univ., 1920; 1913-12, on bldg. constrn., The Rhodes Curry Co., Amherst, N.S.; 1914 (summer), instrument work etc., The Minto Coal Co., Minto, N.B.; 1915 (summer), rodman and recorder, Geol. Surveys; 1915-19, overseas, C.F.A.; 1919-20 (summers), asst. on geol. surveys; At present, office, engr., divn. No. 1, Chippawa-Queenston Power Dev., H. E. P. C. of Ont.

References: F. W. Clark, A. C. D. Blanchard, W. P. Wilgar, A. Macphail, W. L. Malcolm, W. S. Orr, K. C. Fellowes.

NIXON—WILLIAM HERBERT, of 56 Alvin Avenue, Toronto, Ont. Born at Toronto, Ont.; Oct. 31st, 1894; Educ., B.A.Sc., Univ. of Toronto, 1921; 1919 (Aug. and Sept.), material clerk and timekeeper, Toronto, Hbr. Comm.; 1920 (May-Sept.), dftsman., E. A. James & Co., Consltg. Engrs , Toronto; April 1921 to date, res. engr., Toronto and York Comm'n., Toronto.

References: J. R. Wainwright, P. Gillespie, C. R. Young, W. J Smither, E. A. James, W. B. Redfern, E. M. Proctor.

RHODES—GODFREY DEAN, of Nairobi, King's Colony, East Africa. Born at Victoria, B.C., July 18th, 1886; Educ., Grad. R.M.C., Kingston, 1907, 2 years course, military engr'g., Chatham; 1909-10, London & South Western Rly. Workshops; 1910-11, workshops, North Western Rlys., India; 1911-14, asst.-engr., North Western Rly., India; 1914-19, war service, director of rlys., France, Salonika, etc., Major, Awarded D.S.O., C.B.E., Legion of Honour, etc.; 1920 to date, chief engr., Uganda Rly., Nairobi, East Africa, Major, Royal Engrs.

References: W. B. Lindsay, C. J. Armstrong, A. E. Doucet, W. P. Anderson, J. B. Cochrane, W. B. Dawson, A. E. Hodgins, G. B. Hughes, D. Lyell.

SHELTON—JAMES FREDERICK, of Ormond St., Thorold, Ont. Born at St. Helen's, Lancashire, England, April 26th, 1895; Educ., Oxford and Junior Exam. 1911. 2nd session engr'g. student, Univ. of Liverpool, 1919-20; 1912-14, rodman and levelman, C.P.R., Bassano-Empress Rly.; 1915-19, overseas. Royal Engrs., company surveyor and dftsman.; May 1921 to date, dftsman., Welland Ship Canal, Thorold, Ont.

References: F. S. Lazier, C. W. West, E. P. Murphy, A. W. L. Butler, E. S. Miles, D. A. Livingston.

SMITH—KENNETH HUTCHINSON, of Finchfield Road, Wolverhampton, England. Born at Toronto, Ont., Oct. 24th, 1885; Educ., 1902-03, McGill Univ.; 1903-04, reconn. surveys, water works, etc., dftsman. with city engr., London, Ont.; 1904-06, dftsman and instr'man., 1906-10, res. engr., G.T.P.; 1910-11, munic. engr., Vancouver, B.C.; 1911-13, land development, Fort George; 1913-14, govt. land surveys and townsite, Prince George; 1914-19, overseas. Major, Royal Engrs., Mentioned in despatches; At present, private practice, engr. and contractor, design and constrn. of bldgs., Wolverhampton, England.

References: A. H. Smith, J. D. Barnett, H. B. R. Craig, W. J. Forbes- Mitchell, H. A. Brazier, C. H. Mathewson, B. E. Barnhill, R. S. McCormick.

STEVENSON—RAYMOND ROBERT, of Thorold, Ont. Born at Fredericton, N B., Jan. 22nd, 1890; Educ., B.Sc., Univ. of N.B., 1910; Various positions as rodman, levelman, and transitman during college vacations; 1910-12, levelman and transitman on location, C.N.R., Sudbury-Port Arthur; 1912-15, on engr'g. staff of Mount Royal Tunnel, in charge of field party on surveying and constrn.; 1919-21, on engr'g. staff, International Waterways with Rlys and Canals Dept., as assst. engr.; At present, junior engr., Welland Ship Canal, Thorold, Ont.

References: F. S. Lazier, E. P. Murphy, C. W. West, D. W. McLachlan, C. B. Daubney.

ST. LAURENT—JOSEPH EMILE of Winnipeg, Man. Born at St. Anaclet, Que., Sept. 24th, 1885; Educ., C. E. Ecole Poly., Montreal, 1909. Q.L.S.; 1906-08 (summers), student on constrn. work; 1909 to date, with Dom. Public Works Dept. as follows — 1909-11, asst. engr., 1911-15, senior asst., 1915 to date (with exception of 7 mos., Lieut., Can. Engrs. dist engr.

References: [illegible] C. H. Fox.

SUTHERLAND—WILLIAM McKAY, of Glace Bay N.S. Born at Earltown, N.S., Dec. 19th, 1883; Educ., cert. from Mt. Allison Univ. permitting entrance to 3rd year science, McGill Univ.; 1907-13, with Dom. Coal Co. as follows — 1907-09, instr'man., surface and underground, 1909-11, dftsman., C.E. dept., 1911-13, dftsman., struct'l and mech.; 1915-20, mech. and struct'l design, plant equipment, Nova Scotia Steel & Coal Co.; Dec. 1920 to date, checker and designer of struct'l. and mech. equipment, surface and underground, Dom. Coal Co., Glace Bay, N.S.

References: C. M. Odell, K. H. Marsh, D. Morrison, H. C. Chipman, R. L. Waycott, W.G. Matheson.

URE—WILFRED GORDON, of Woodstock, Ont. Born at Woodstock, Ont., Oct. 2nd, 1891; Educ., B.A.Sc., Univ. of Toronto, 1913; O.L.S. 1920; asst. on gen . munic. and drainage engr'g. work with F. J. Ure, Woodstock, Ont. during vacations; 1913-14, dftsman and timekeeper, Wells & Gray Ltd. Engrs. and Contractors, Toronto and Windsor, Ont.; 1914-15, asst. to A.B. Manson, City Engr., Stratford, Ont.; 1915-19, general contracting engr., Wells & Gray Ltd., Toronto; April 1919 to date, member of firm, F. J. Ure & Son, Civil Engrs. and Surveyers, Woodstock, Ont.

References: P. Gillespie, F. A. Dallyn, C. R. Young, A. H. Harkness, G. C. Hoshal, A. B. Manson, F. J. Ure.

FOR TRANSFER FROM CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

BURNETT—JAMES AUBREY, 513 New Birks Building, Montreal, Que. Born at Montreal, Sept. 14th, 1873; Educ., Fettes College School, Montreal, 1890-91, 1893-97, dftsman Royal Electric Co.; 1898, meter dept., Can. Gen. Elec. Co.; 1899-1900, dftsman., Royal Electric Co.; 1902, constrn. of large sub-station for M.L.H. & P. Co., on Wellington St., Montreal; 1908-10, constrn. of Montreal & Southern Counties Rly.; 1912-13, install'n. of elect'l. equipment on Black Rock (Buffalo) swing span; 1920-21, appraisal of all elect'l. equipment on Grand Trunk System for govt. arbitration; At present, consltg. and appraisal engr., Smart & Burnett, Montreal, Que.

References: A. Surveyer, J. T. Farmer, K. B. Thornton, H. Holgate, J. H. Hunter, C. Thompson.

MACPHAIL—JOHN GOODWILL, of Ottawa, Ont. Born at Orwell, P.E.I., Dec. 18th, 1877; Educ., B.A. 1903, B.Sc., (C.E.) 1905, Queen's Univ.; 1903 (summer), on munic. water supply with Moore & Gowing, Boston; 1904 (summer), Ontario Power Co. on hydro-elec. development; 1905-08, engr. on comm'r. of lights staff, Marine Dept., Ottawa; 1908-11, acting comm'r .of lights, and 1911 to date, comm'r. of lights, Marine Dept., Ottawa.

References: G. J. Desbarats, G. R. MacLeod, A. Macphail, T. S. Scott, W. P. Wilgar, V. F. W. Forneret, C. P. Edwards, B. H. Fraser, L. E. Cote.

O'BRIEN—DOMINIC EDWARD, of 143 Ontario Street, St. Catherines, Ont. Born at Merrickville, Ont., Aug. 5th, 1882; Educ., C.E. Univ. of Toronto, 1905; 1903 (summer) levelman, Locomotive & Machine Works, Montreal; 1904 (summer), asst. to town engr., Cornwall, Ont; 1905, transitman, T.C.Rly.; 1906, transitman, C.P.R., 1907-08, res. engr., water & sewers, Dalhousie, N.B.; 1909-13, res. engr., T. C. Rly. dist. E., Nipigon, Ont.; 1913-18, asst. engr., Welland Ship Canal; 1918-21, chief engr. Halifax Shipyards, Ltd., Halifax, N.S.; April 1921 to date, senior asst. engr., Welland Ship Canal, St. Catharines, Ont.

References: A. J. Grant, W. H. Sullivan, F. E. Sterns, F. W. W. Doane, J. H. Holliday, E. A. Forward, M. J. Haney, C.B. Brown, W.A. Duff, J.L. Weller, C. E. W. Dodwell, H. S. Johnston.

WATSON—GEORGE LINTON, of 16 East 41st Street, New York, N. Y. Born at Camden, N.J., Dec. 13th, 1879; Educ., 2 years special tuition in engr'g.; 1898, student with and asst. to Prof. John Willis, Consltg. Geologist; 1901-04, associated with Arthur Donnelly, C.E. in development of coal properties, sewer and water design and constrn. in Ohio, West Virginia and Penna.; 1903, asst. supt., night supt. and later managing engr., Vinton Colliery Co.; 1905-08, private practice, Watson & Szlapka, Philadelphia, Pa.; 1909, res. engr., mill and hydro elec. development at Narrows, Pa. Advisory engr. on constrn. Bronx Valley Trunk Sewer; 1909-17, private practice; 1917-19, overseas. U.S. Engrs., Lt.-Col.; 1919, special duty for U. S. Govt. Panama Canal Dept.; 1920 to date, member board of consltg. engrs., New York State Bridge & Tunnel Comm., New Jersey Bridge & Tunnel Comm., City of Clifton, N.J City of Saltaire, N.Y.

References: J. V. Davies, R.S. Buck, G.W. Fuller, F.A Snyder, G.A. Johnson, R. Hering, J. Forgie.

WRIGHT—GEORGE CLARK, of London, Ont. Born at Kingston, Ont., April 17th, 1885; Educ., B. Sc., (C.E.), Queen's Univ., 1907; 1903-05, G.T.R. and T.N.O Rlys. surveys; 1907, instr'man., T. & N.O. Rly.; 1909, articled pupil, to F. F. Miller, O.L.S.; 1908-09, asst. engr. to H. B. R. Craig, City Engr., Kingston, Ont.; 1909-18, member of firm, Campbell & Wright, Surveyors & Engrs., Kingston Ont.; 1912 to date, engr. and vice-pres., Kingston Construction Co. Ltd., of Kingston and London, Ont. Consltg. engr. in general practice.

References: H. B. R. Craig, H.A. Brazier, F.F. Miller, W.L. Malcolm, A. Macphail, D. S. Ellis.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

ALLEN—LEONARD EDGAR, of 137 Rideau Terrace, Ottawa, Ont. Born at Ottawa, Ont., Sept. 28th, 1882; Educ., Ottawa Collegiate Institute; 1904-07, rodman and leveller, C.P.R., mtce of way dept.; 1907-11, transitman and asst. res engr., C.P.R. mtce. of way dept.; 1911-14, dist. office engr., N.T.C. Rly.; 1914-17, Overseas., Can. Engrs.; at present supervising work in the Civil Service, Ottawa.

References: J. M. R. Fairbairn, G. Grant, W. A. Richards, W. M. Tobey, J. E. N. Cauchon, A. M. Jones.

BOAST—RICHARD GRIFFITH, of Box 892, North Bay, Ont. Born at DeSmet, South Dakota, U.S.A., Feb. 22nd, 1885; Educ., B. Sc.,(C.E.) McGill Univ. 1911; 1905 (May-Dec.), rodman, Orford Mountain Rly., Kingsbury, Que.; Dec. 1905 to Sept. 1906 and summers 1907 and 1908, rodman, Boston & Maine Rld., St. Johnsbury, Vt.; 1910 (summer), instr'man on constrn., C.P.R. Western lines; 1911 to date successively, inst'man., res. engr. and engr. mtce of way, T. & N.O.Rly., North Bay, Ont.

References: S.B.Clement, R.A.C. Henry, D. C. D. Briercliffe, W.O. Cudworth, H. W. Sutcliffe, C. F. Szammers, W. R. Maher.

PIRIE—ALEXANDER, of 119 Pender St West, Vancouver, B C Born at Lossiemouth, Scotland, Dec. 16th 1888; Educ., corres. course. 1905-11, articled to C.C. Doig, Architect and C.E. Elgin, Scotland; 1911-12, rodman, dfts'man., topog'r. and leveller, Water Power Surveys, Winnipeg River; 1912-15, asst. engr., Dom. Water Power Branch, Winnipeg, Man.; 1915-19, overseas; 1919 to date, asst. engr., Dom. Water Branch, Vancouver, B C

References; J.B Challies, J T. Johnston, R G Swan, C L Webb D L McLean.

REID—RUPERT HARRINGTON, of Timmins, Ont. Born at Sault Ste. Marie, Ont., Oct. 5th, 1886; Educ., B.Sc., McGill Univ., 1910; 1904-08, electrician, Algoma Steel Corpn., Sault Ste. Marie, Ont.; 1909-12, instr'man., Lake Superior Power Co.; 1912-13, supt. of constrn., hydro-elec. plant, Steep Hill Falls, for mines dept., Algoma Steel Corpn.; 1913-16, asst. engr., Welland Ship Canal; 1916-19, overseas. Lieut., Can. Artillery; 1919 (3 mos.), asst. engr., Welland Ship Canal; At present, in charge of electr'l, constrn. work. elect'l. dept., Hollinger Mining Co., Timmins, Ont.

References: J. L. Weller, W. H. Sullivan, F. E. Sterns, J. W. LeB. Ross, L. A. Herdt, G. H. Kohl.

THEXTON—ROBERT DONALD, of Twyford, Hants., England; Born at Lindsay, Ont., May 19th, 1890; Educ., 4 years scientific course, Davenport High School; 1908-09, dftsman., Peoples Light & Power Co., Davenport, Iowa; 1911-13, rodman and instr'man.,C.N.R.;1913-14, asst. to Major D.Barry, Connaught Rifle Range, Militia Dept.; 1914-19, overseas. Capt., Can. Engrs.; 1919, engr., engr'g. branch, Dept. Militia and Defence; 1920-21, section engr. on constrn., Federated Malay States Rlys.; Now going to the Nigerian Rly. as engr. on constrn.

References: A. P. Deroche, D. Barry, H. E. Maple, H. B. Miller, G. B. Hughes.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

DOHERTY—CHARLES ALEXANDER, of Hitchin, Herts., England. Born at Erin, Ont., June 18th, 1892; Educ., Univ. of Toronto, 1911-13; 1911 (summer), G.T.P.Rly.; 1912-13 (summers), with R. Forfar, Bldg. Contractor, Toronto and Scarboro; 1914-16, with Baldey, Gerburgh & Hutchinson, Contractors, as asst. to chief engr., and later in charge of all excavation work and supervising concrete work on No. 2 Section, Welland Ship Canal; 1916, overseas with C.F.A. as comm'd. officer; 1917-18, Dept. of Fortification and Works, War Office, res. engr., in charge of constrn.; Sept. 1918, transferred to Air Constrn. Service, Royal Air Force, and placed in charge of all engineer and works services on aerodromes in Eastern and Midland Counties. Territory afterwards enlarged to include western and northern counties. Remained in charge until the disbandment of the Air Constrn. Service and its reorganization on a civilian basis as a branch of the Civil Service Air Ministry, when he was appointed (and at present), sub-area officer, rank of Major and grading of civil engr., in charge of all new constrn. and mtce. of all permanent air stations from London and Bristol as far North as Liverpool and Hull.

References: A R. Sprenger, C. R McCort, S. A Hustwitt, S A. Lanzon, E P Muntz,. W. L. Dobbin

EDWARD—ARTHUR JAMES, of Three Rivers, Que. Born at Lachine, Que., Oct. 10th, 1896; Educ., B.Sc., (Chem. Eng.), McGill Univ. 1920; surveying, dfting. and constrn. work during vacations;instr'man. on constrn. of Camp Borden Mil. Camp, with Bate & McMahon Constrn. Co. Ottawa; instr'man on constrn., Leaside Aviation Camp, Toronto; 1918-19, overseas with tank corps; 1920, res. engr., International Paper Co., Berlin, N.H.; At present, chem. engr. in operation of St. Maurice Lumber Co. — New Mill, International Paper Co., Three Rivers.

References: C. M. McKergow, A. R. Roberts, W. B. Mackenzie, T. M. Montague, A. Gray, J. B. Porter.

JICKLING—ROBERT WILLIAM, of 396 Victor Street, Winnipeg, Man. Born at Morden, Man., March 8th. 1897; Educ., B.Sc. (E.E.), Univ. of Manitoba, 1920; topog'r. for C.P.R.; junior clerk and helper to wireman, City of Winnipeg Hydro-Elec. System at Pointe du Bois; At present, testing and inspecting of overhead distribution system transformer lines, etc. City of Winnipeg Hydro-Elec. System.

References: C. A. Clendening, E. V. Caton, E. P. Fetherstonhaugh, J. W. Dorsey, E. A. Childerhose, N. M. Hall.

PICARD—PETER ALBERT, of Indian Lorette, Que. Born at Indian Lorette, Que. Dec. 19th, 1880; Educ., surveying and mapping and complete drawing course, I.C.S.; 1903-04, asst. to L. A. Dufresne, C.E., Sherbrooke, Que.; attended Royal Military School of Infantry, Quebec; 1906-07, i/c of dfting on location also divn'l. dftsman and instr'man on constrn., T.C.Rly.;1908-15, gen. dfting., checking, and estimating, T.C.Rly. office, Quebec; (1909), also prospecting in Labrador and Eastern Townships, Quebec; 1915 (June and July, making plans and profiles, aqueduct and sewer system, Victoriaville, Que.; 1915-16, asst. engr., prov. highway constrn., Quebec; 1917-19, asst. engr., Quinlan & Robertson, Ltd., Limoilou, Que., shipbldg, etc., 1919-20, surveying, dfting., estimating, etc., Quebec prov. highways dept.; At present, mapping, reference books, descriptions, etc., Dept. Colonization, Mines and Fisheries, Cadastre Branch, Prov. Govt.,

References: J. O. Montreuil, E. A. Forward, J. Dumont, A. Tremblay, Z. Langlais, L. C. Dupuis.

TRUDEAU—ALPHONSE, of Ste Anne de Bellevue, Que. Born at Montreal, Que., June 19th, 1894; Educ., B.Sc., McGill Univ., 1917.; 1917 (4 moc.), engr. for G. B. Mitchell, Gen. Contractor, Montreal; 4 mos. Atlas Constrn. Co., 1918-19, Lieut., Can. Engrs., 1919-21, engr. and supt. Atlas Constrn. Co.; 4 mos. with Montreal Water Board.

References: H. M. MacKay, C. M. Morssen, J. A. Jette, A. S. Dawes, W. Dickson.

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ENGINEERING JOURNAL
THE JOURNAL OF
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CONTENTS

Volume V, No. 2

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BRANCHES:

Halifax Branch, Halifax, N.S.
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Kingston Branch, Kingston, Ont.
Peterborough Branch, Peterborough, Ont.
Toronto Branch, Toronto, Ont.
Hamilton Branch, Hamilton, Ont.
Niagara Peninsula Branch, Niagara Falls, Ont.
London Branch, London, Ont.
Border Cities Branch, Windsor, Ont.
Sault Ste. Marie Branch, Sault Ste. Marie, Ont.
Winnipeg Branch, Winnipeg, Man.
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THE

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ENTERED AT THE POST OFFICE, MONTREAL, AS SECOND CLASS MATTER

VOLUME V | MONTREAL, FEBRUARY 1922 | NUMBER 2

Report of Council for the Year 1921.

Of the varied phases of *The Institute's* activities to distinguish the year 1921, the establishment of three new Branches, one at Sydney, Nova Scotia, known as the Cape Breton Branch, one at London, Ontario, and the other at Lethbridge, Alberta; a very substantial increase in membership and an expansion of Branch activities are the more notable.

It is undeniable that the year just closed has been one of the poorest from the view-point of engineering operations for many years, resulting in considerable individual hardship on account of unemployment, which condition Headquarters has sought in every way to alleviate, but, on account of economic conditions, with indifferent success. It is some satisfaction to note that the outlook for the coming year is more promising.

This year has seen the greatest engineering gathering yet held in Canada, when, under the auspices of the Toronto Branch, the Annual Professional Meeting was held in that city in February, the success of which was largely attributed to the organizing ability of the Toronto Branch Officers, and was an indication of the fact that engineers are becoming more and more alive to the advantages of meeting for social and professional intercourse. The Professional Meeting at Saskatoon, while fewer in numbers, was marked by continuous enthusiasm, and by a series of papers that would be a credit to any engineering gathering. A Council meeting was also held during this meeting. Authorization was given for a Council meeting to be held in Ontario during the current year, at a date to be set by the Ontario Provincial Division.

The difficulties involved in connection with the work of the Committee on Policy, due to its breadth of scope and the many factors presented to it for consideration, became apparent during the year, and although the Committee has done a great deal of work it has been found impossible to put the result into final shape without a meeting of the Committee, and it is therefore recommended to the incoming Council that a meeting be held shortly of the Committee.

Classification and Remuneration have been advanced to a point where the Committee's final report is under consideration by Council at the present time, and it is anticipated that this report will be submitted to the various Branches in the immediate future, for discussion and suggestions.

The report of the special committee on Publications, dealing with the question of rules and regulations regarding the publication of papers presented at Branches and

Professional Meetings, has been approved by Council, and will be found printed under Institute Committee reports.

Various Institute Committees in addition to those already mentioned, have done notable work during the past year. Of outstanding importance is that of the Committee on the Deterioration of Concrete in Alkali Soils, which is endeavouring to solve the problem which confronts the Prairie Provinces. The sum of thirteen thousand dollars has been raised to follow up more effectively the work done by this Committee during the past two years. The thanks of *The Institute* are due the Honorary Advisory Council for Scientific and Industrial Research, the Canadian Pacific Railway, the Canada Cement Company, the Province of Alberta, the Province of Saskatchewan, and the City of Winnipeg. It is hoped that this Committee's results will be of lasting benefit to the profession.

The happy relations existing between *The Institute* and the four founder engineering Societies of the United States, is illustrated by the fact that arrangements have been made with the American Society of Mechanical Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Civil Engineers, and the American Institute of Electrical Engineers, whereby members of this *Institute* receive all the Transactions and publications of the founder Societies at the same price as that paid by their own members. In the case of the American Institute of Electrical Engineers, this amounts to the same price as paid by the members for transactions, in addition to their dues. With the other Societies it is amount paid by members for additional copies, and is equivalent in most cases to a fifty percent discount on the advertised rates. *The Institute* extends a similar courtesy to the sister societies, and it is hoped that the arrangement will be mutually beneficial.

The strength of *The Institute*, and its growth in the professional field, is well reflected in the operations of *The Institute* as a whole during the past year. Every Branch has shown a satisfactory growth, resulting in about fifteen percent increase in membership. For the first time a budget system was adopted by the Finance Committee, and the financial statement is one which reflects a flourishing organization, while the very large number of papers presented at professional and branch meetings, as shown in the reports, is an indication of the general activity of *The Institute.*

While lamenting the loss by death of a number of prominent members of *The Institute*, it is with particular regret that Council records the death of Sir John Kennedy, K.B., Hon. M.E.I.C., a charter member of *The Institute*, Past-President, one of its first Vice-Presidents, and for eleven years a Councillor, in honour of whose position in the engineering world, it is proposed to place a bronze tablet in *The Institute* Headquarters.

Meetings

Professional meetings were held as follows:—

Annual General Professional Meeting held in Toronto, Ont., February 1st., 2nd., and 3rd, 1921, at which the following papers were read:—

"Design of Sewage Disposal Scheme for a City located on Tidal Waters", by C. J. Yorath, A.M.E.I.C.

"Cost-Plus Contracts", by J. Clark Keith, A.M.E.I.C.

"Hydrated Lime a Chemical Engineering Product", by Lucius E. Allan, M.E.I.C.

"Toronto Filtration Plant", by James Milne, M.E.I.C.

"Heating and Ventilation of Paper Machine Rooms", by Edward A .Ryan, A.M.E.I.C.

Practice of Ventilation of Paper Machine Rooms", by E. A. Briner.

"Mechanical and Electrical Equipment of the Toronto Union Station", by Walter J. Armstrong, A.M.E.I.C.

"The Canadian Pulp and Paper Industry", by T. Linsey Crossley, A.M.E.I.C.

"Chemical Engineering in the Packing House", by J. Richardson Donald.

"Present Day Illumination Standards", by George C. Cousins.

"Municipal Engineering", by R. O. Wynne-Roberts, M.E.I.C.

"The Activated Sludge Process of Sewage Disposal", by George G. Nasmith.

"Some Controversial Points in Concrete Specifications", by Frank Barber, A.M.E.I.C.

"On the Economics of Building Construction", by J. Morrow Oxley, A.M.E.I.C.

"Toronto Harbour Improvements", by Edward L. Cousins, A.M.E.I.C.

"Control of Corrosion in Iron and Steel Pipes" by F. N. Speller.

Tenth General Professional Meeting held at Saskatoon, Sask., August 10th, 11th, and 12th, 1921, at which the following papers were read:—

"The Development of Trunk Highways as Affecting the "Western Provinces", by C. W. Dill, M.E.I.C.

"Water Supply and Irrigation Schemes of the Prairie Provinces", by G. N. Houston, M.E.I.C.

"The Audion and its Applications", by R. S. Parker, A.M.E.I.C., and S. B. Sherman, A.M.E.I.C.

"The Self-Corrosion of Cast Iron and other Metals in Alkaline Soils", by W. Nelson Smith, M.E.I.C., and Dr. J. W. Shipley.

"What about Western Coal", by R. de L. French, M.E.I.C.

"The Coal Situation of Western Canada", by William Pearce, M.E.I.C.

"Economics and Engineering Features of the Manitoba Power Commission", by J. Rochetti, M.E.I.C.

"The Water Powers of the Prairie Provinces", by C. H. Attwood, A.M.E.I.C.

"Northern Territory in Western Canada, Its Development and Problems", by R. C. Wallace.

"The Disintegration of Concrete in Alkali Soils", by G. M. Williams, A.M.E.I.C.

Roll of the Institute

Elections during the year resulted in the following additions to the roll:—one Honorary Member, seventy-one Members; three hundred and thirty Associate Members; one hundred and fifteen Juniors; three hundred and forty-seven Students and ten Associates.

The following transfers were made:—thirty-eight Associate Members to the class of Member; one Associate to the class of Member; thirty-seven Juniors to the class of Associate Member; twenty-five Students to the class of Associate Member; twenty-one Students to the class of Junior.

The following is a detailed statement of elections and transfers which have taken place. These are included in the official membership roll as acceptances are received and have been published monthly in *The Journal* immediately after election:—

Elections.

Month	Hon. Member	Members	Associate Members	Juniors	Students	Associates
January.....		6	25	23	103	
February...					66	
March.....		13	61	18	47	1
April.......						
May.......		2	14	9	19	2
June.......		17	87	22	2	4
July.......						
August....		14	79	21	5	1
September..		12	48	18	5	2
October....		4	7	1	50	1
November..		3	9	3	12	
December..	1				38	
	1	71	330	115	347	10

Transfers

	A.M. to M.	Assoc. to M.	Jr. to A.M.	S. to A.M.	S. to Jr.
January...	4		2	2	5
February..					
March.......	9		6	4	2
April......					
May......	4		5	3	1
June.......	9	1	7	9	7
July......					
August	6		6	3	2
September...	3		6	3	1
October......	1		5		3
November.....	2			1	
December......					
	38	1	37	25	21

Removals from Roll

There have been removed from the Roll by resignation or on account of non-payment of dues:—sixteen Members; fifty Associate Members; seventy-one Juniors; one hundred and six Students and ten Associates. A detailed list of resignations accepted is as follows:—

Members.............Barton, Donald S.
Crenshaw, Smith S.
deLotbinière, A. C. Joly.
Fergie, Charles.
Frost, Harwood
Leach, Lt.-Col. Francis E.
Macintyre, Robt. Wentworth
Tarr, Charles Winthrop
Weatherbe, Lt.-Col. Paul
Webster, Henry
Wilkin, Lt.-Col. Francis A.

Associate Members....Ayer, Kenneth Roger
Bagshawe, Frederick T.
Charton, Capt. Pierre
Cowin, James
Dion, Alfred Hector,
Eriksen, Borge O.
Finlay, Delmar C.
Freeland, Philip Broke
Godwin, Benjamin
Harris, A .Dale
Hodge, Charles A.
MacNeil, Hector
Mullarkey, John P.
Smith, Geo. W.
Whitney, Arthur W.

Junior.................Stanley, Major H. P.

Students..............Emmons, E. F.
Gervan, C. F.
Godin, Charles
Haliburton, E. D.
Hayward, John Gray
Hovey, John A.
Jamieson, Eldred
MacDonald, J. P.
McLean, John Reginald
McLellan, N. W.
Pfeiffer, Walter M.
Payment, Euclide
Sirett, E. James
Tanton, John F.
Warner, Donald Franklin
Wright, E. S.

Associates............Bate, Wm. C.
Cowan, John Robert
Morrison, Thomas A.

Deceased Members

The following deaths, thirty-two in number, have been reported, of which number, eight were killed in action or died as the result of wounds and illness contracted during war service.

Members.............Bayne, Geo. Arthur
Burley, Ralph J.
Busteed, F. F.
Fawcett, Thomas
Hill, Albert James
Kennedy, James Cron
Kennedy, Sir John, LL.D. (Hon. Member)
Langton, John
McKay, Owen
Robb, Aubrey Granger
Sing, J. G.

	Tomlinson, A. T.
Associate Members....	Chataway, Chas. T.
	Drummond, T.
	Girard, Joseph E.
	Keefer, E. C.
	Mason, Major John
	McLellan, John Wm.
	McPhee, Capt. Murdoch N.
	Phillips, Archibald M.
	Powell, Major Alan Torrance
	Ruhl, Harry Thornton
	Stuart, William James
	Thorne, Major Stuart M.
	Waldron, Major Stanley M.
Juniors................	Allan, Lieut. H. D.
	Davis, Wm. James
	Duff, Miles O'Reilly
	Williams, Jack Northmore
Students.............	Jacquemart, Rene
	Probst, Emile
Associate.............	Kammerer, Jacob A.

Killed in action or died as the result of wounds, and illness contracted during war service:—

Associate Members....	Mason, Major John
	Powell, Major Alan Torrance
	Stuart, Lieut. William James
	Thorne, Major Stuart M.
	Waldron, Major Stanley M.
Junior................	Allan, Lieut. H. D.
Students.............	Jacquenart, Rene
	Probst, Emile

Total Membership

At present the membership stands as follows:—

Honorary Members............	10
Members.....................	1018
Associate Members............	2285
Juniors.......................	438
Students.....................	899
Associates....................	38
	4688
Elected — acceptances pending.	191
	4879

Respectfully submitted,

J. M. R. FAIRBAIRN,
President.

FRASER S. KEITH,
Secretary.

Library and House Committee

The President and Council,

On behalf of the Library and House Committee I beg to submit the following report. Your Committee had hoped to have a complete catalogue of the Library printed during the present year, but owing to other expenditures made by your Committee it was considered necessary to hold issuance of the catalogue until a later period. The present Library is catalogued according to a modification of the Dewey decimal system, published by the American Society of Civil Engineers a few years ago. Since its adoption by *The Institute* the United Engineering Societies Libraries, comprising the joint libraries of all the founder engineering societies of the United States, has adpoted the Dewey decimal system in its original form, and your Committee recommends that this system be adopted in *The Institute's* Library.

Additional equipment for the Assembly Hall was provided by the addition of fifty chairs, and in view of further accommodation being necessary, your Committee is now investigating the cost of providing additional by the means of a gallery. Should the cost of this prove too great it is recommended that an additional fifty chairs be purchased.

The question of improving the ventilation has received considerable thought, and a report is now in progress to Council, outlining this subject, together with that of increased accommodation.

It is felt by your Committee that the Library would be strengthened by the purchase of a number of modern engineering text-books, provision for which might be made in the budget for the coming year, if the suggestion meet with your approval.

Publication Received

The following publications were presented to *The Institute* during the year.—

By Octave Doin, publisher, Paris.

"La Technique des Pétroles" by R. Courau.

By the Institute of Naval Architects.

"Transactions of the Institution of Naval Architects

By Masson et Cie., publishers, Paris.

"Traité de Chimie Physique", translation by Wm. C. Lewis.

By D. Van Nostrand Company, New York, publishers.

"Cam. Design and Manufacture" by F. B. Jacobs.

By Canadian Engineering Standards Association.

"Standard Requirements for Single-Phase Distribution".

By National Board of Fire Underwriters, Bureau of Standards and Associated Factory Mutual Fire Insurance Companies.

"Fire Tests of Building Columns."

By American Concrete Institute.

Proceedings, Vols. 1 to 8; 12 to 16.

By A. C. Tagge, M.E.I.C.

Proceedings of the Royal Society of Canada, 1883 to 1892 inclusive.

By R. W. Leonard, M.E.I.C.

Book of Plans of New York State Barge Canal.

By Roy Campbell, A.M.E.I.C.

"Construction du Canal de Jonage", by Réné Chauvin, published by La Société Lyonnaise des Forces Motrices du Rhône.

By H. B. Muckleston, M.E.I.C.

"Flow of Water in Irrigation Canals", by P. J. Flynn.

"Irrigation Canals and Other Irrigation Works", by P. J. Flynn.

By Chester B. Hamilton, Jr., M.E.I.C.
"Hamilton's Gear Book".
By the Joint Commission on the Bridge over the Delaware at Philadelphia.
Report on the Bridge over the Delaware at Philadelphia.
By E. and F. Spon, publishers, London, England.
"Reinforced Concrete Construction", by M. T. Cantell, A.M.E.I.C.
By McGraw-Hill Company, publishers, New York.
Federated Engineering Societies Report on Waste in Industry.

Respectfully submitted,

ALEX. BERTRAM,
Chairman.

Papers Committee

The President and Council,

On behalf of the Papers Committee I beg to submit the following report for the year 1921.

The Papers Committee is composed of the Chairman of the various Branches of the Institute with myself as Chairman of the whole Committee. On account of the members of the Committee residing so far apart, no attempts have been made to hold any meetings, but the Committee, nevertheless, has provided a means of interchange of papers between the Branches.

The activities of the Branches have been carried out so successfully that there has not been any great demand on the Papers Committee of the Institute for assistance but a number of meritorious papers have been sent in and I have referred them to other Branches for their use.

Respectfully submitted,

FREDERICK B. BROWN,
Chairman.

Committee on Legislation and By-Laws

The President and Council,

On behalf of the Committee on Legislation and By-Laws, I have the honour to report that peace and harmony has prevailed throughout the whole year as far as this Committee is concerned, and that nothing beyond the formal approval of Branch By-Laws has been submitted to the Committee.

Your Committee has kept in close touch with the legislation situation throughout the whole Dominion, and confidently believes that the period of evolution through which the profession is now passing will end in the haven of recognition already attained by our sister professions — law and medicine. This end cannot be reached by us, however, until its need is fully recognized by our members, and by everyone engaged in any branch of the profession, as well as by our legislators, and it is more than ever incumbent upon us, each and every one, to act in such a way that the public will appreciate our high ideals and in the end realize the wonderful part the engineer is playing in our great civilization.

Respectfully submitted,

WALTER J. FRANCIS,
Chairman.

Finance Committee

The President and Council,

On behalf of the Finance Committee, I have the honour to submit herewith the Financial Statement for the year 1921.

In presenting this statement, I would venture to call your attention to the fact that this is the first year during which the financial affairs of *The Institute* have been upon a budget system. The estimated operating surplus appearing in the budget prepared at the beginning of 1921 was $10,468. The actual operating surplus as certified by your Auditors is $10,313.73 exclusive of the hereinafter mentioned recommendation regarding the disposal of entrance fees. This is a satisfactory result in view of the difficulty of estimating either the revenue or expenditure on the items of *Journal* and transactions.

The Committee begs to recommend that as much as possible of the 1921 entrance fees be reserved to discharge our mortgage obligations, and for the future the whole of this amount be set aside for said purpose until such time as the mortgage is wiped out.

The Committee further recommends that the budget system be continued, and that for the future three annual statements be prepared for the Council:—

(a) Balance Sheet.
(b) Statement of Cash Receipts and Disbursements.
(c) A statement showing the operating condition of *The Institute.* This statement should include not only the cash but Bills Receivable and Bills Payable in order that the members may observe quickly the actual financial status of *The Institute.* This statement would correspond to the one that has been submitted to the Council from year to year.

Respectfully submitted,

R. A. ROSS, *Chairman.*

The President and Council,

Dear Sirs:—

We have completed the Audit of the Books ane Accounts of *The Engineering Institute of Canada* for thd year ending 31st December 1921, and submit herewith Statements of Assets and Liabilities as at that date and Revenue and Expenditure for the past year duly certified by us.

All expenditure has been properly supported by vouchers. The cash on hand and in Bank has been verified and the Investments held have been verified by personal inspection.

We append hereto a Schedule showing the position of the various Special Funds.

We certify that we have obtained all the information and explanations we have required, and that, in our opinion, the accompanying Balance sheet is properly drawn up so as to exhibit a true and correct view of the state of the affairs of *The Institute* as at 31st December 1921.

Faithfully yours,

RIDDELL, STEAD, GRAHAM and HUTCHISON, C.A.
Auditors.

STATEMENT OF ASSETS AND LIABILITIES AS AT 31st, DECEMBER 1921

Assets.

PROPERTY ACCOUNT		$89,041.64
FURNITURE		
Balance as at 1st Jan. 1921	2,999.95	
Added during year	1,283.81	
	4,283.76	
LESS 10% written off for Depreciation.	428.37	3,855.39
LIBRARY:		
Estimated Value of Books as at 1st Jan. 1921	6,330.00	
LESS 10% written off for Depreciation.	633.00	5,697.00
STATIONERY ON HAND, as per Inventory		900.00
GOLD MEDAL		45.00
INVESTMENTS:		
Canada Permanent Mortgage Corporation stock, 20 shares par value $10 each	215.00	
Montreal Light, Heat & Power Co., stock, 6 shares par value $100 each.	120.50	335.50
ACCOUNTS RECEIVABLE:		
Journal	4,736.80	
Advances to Branches	1,000.00	
Sundry	4.61	
		5,741.41
ARREARS OF FEES — Estimated		2,500.00
CASH		
Canadian Bank of Commerce Current Account	3,477.55	
Petty Cash on Hand	200.00	
		3,677.55
INSURANCE UNEXPIRED		147.37
SPECIAL FUNDS:		
Investments Victory Bonds	2,000.00	
Cash in Savings Bank Accounts	1,147.69	
		3,147.69
		$115,088.55

Liabilities.

MORTGAGE ON PROPERTY		
Royal Institute for the Advancement of Learning	$20,000.00	
Interest thereon accrued to date	233.33	
		20,233.33
ACCOUNTS PAYABLE:		
Sundry	134.81	
Advances to Branches	816.87	
		951.68
SPECIAL FUNDS (as per Schedule No. 1 attached)		3,147.69
SURPLUS ACCOUNT:		
Balance as at 31st Dec. 1920	80,442.12	
Add Surplus for year 1921	10,313.73	
		90,755.85
		$115,088.55

MONTREAL, 10TH JANUARY, 1922.

Verified subject to our report of this date.

(Signed) RIDDELL, STEAD, GRAHAM & HUTCHISON, C.A.
Auditors.

STATEMENT OF REVENUE AND EXPENDITURE FOR THE YEAR ENDED 31st, DECEMBER 1921

Revenue.

SUBSCRIPTIONS:		
Arrears of Fees	$5,610.25	
Current Fees	24,127.02	
Advance Fees	478.77	
Entrance Fees	9,661.50	
		39,877.54
INTEREST:		
On Overdue Fees		473.48
DIVIDENDS:		
Canada Permanent Mortgage Corporation Stock	21.30	
Montreal Light, Heat & Power Co. Stock	30.00	
		51.30
JOURNAL:		
Net Revenue		6,204.89
BANK EXCHANGE		48.15
RENT OF HALL		60.00
CERTIFICATES		721.50
BADGES		52.67
EXAMINATION FEES		8.00
		$47,497.53

Expenditure.

BUILDING EXPENSE:		
Interest on Mortgage	$1,400.00	
Taxes	1,373.89	
Water rates	203.70	
Fuel	770.92	
Insurance	122.96	
Light and Gas	129.84	
Caretaker's Wages and Service	1,187.50	
Repairs and Expense	948.03	
		6,136.84
OFFICE EXPENSE:		
Salaries, Secretary and Office Staff	14,378.32	
Office Supplies and Stationery	2,509.21	
Postage and Telegrams	1,415.55	
Auditors' Fees	250.00	
Telephone	194.79	
Messengers and Express	63.71	
Miscellaneous Expense	207.71	
Legal Expense	7.98	
		19,027.27
PUBLICATION:		
Transactions		1,840.30
GENERAL EXPENSES:		
Annual and Professional Meetings	1,422.36	
Donation C.E.S.A.	200.00	
Travelling Expenses, Secretary	1,298.30	
Branch Stationery	224.27	
Gzowski Medal	12.10	
Students' Prizes	25.00	
Library Expenses and Magazines	464.77	
10% written off Furniture for Depreciation	428.37	
10% written off Books for Depreciation	633.00	
		4,708.17
REBATES TO BRANCHES:		
As per Schedule No. 2 attached		5,471.22
		$37,183.80
BALANCE being Surplus of Revenue over Expenditure for the year ending 31st December, 1921		10,313.73
		$47,497.53

Montreal, 10th January, 1922.
Verified:
(Signed) RIDDELL, STEAD, GRAHAM & HUTCHISON, C.A.,
Auditors.

Canadian Engineering Standards Committee

The President and Council,

On behalf of the Canadian Engineering Standards Committee, I beg to submit the following report:—

Personnel

The Institute is honoured with having three members on the Main Committee of the Canadian Engineering Standards Association. At the beginning of this year the personnel of this Committee was as follows:—W. F. Tye, M.E.I.C., for one year; H. H. Vaughan, M.E.I.C., for two years; and the writer, for three years.

During the past year the work of the Association has developed considerably. The various working committees now complying upwards of 250 members, and the number is constantly increasing as work is commenced on new subjects. In the prosecution of this work *The Engineering Institute* is vitally interested, and over half the number of the Committee members are members of *The Institute.*

Publications

The publications during the year are as follows:—

No. 3, 1921, Standard Specifications for Galvanized Telegraph and Telephone Wire.

No. 4, 1921, Standard Specifications for Wire Rope for Mining and Dredging Purposes.

The Specification for Portland Cement is in the press.

The following publications are in an advanced stage of progress, and will shortly be ready for submission to the Main Committee for authority to print:—

Reprint of Standard Specification for Steel Railway Bridges.

Standard Specification for Steel Highway Bridges.

Standard Requirements for A.C. Watt-hour Meters.

Outside Relations

The establishment of cordial relations with the various European national standardizing bodies has been an important feature of the year's work. An arrangement has been approved by the Main Committee and is now in effect whereby information as to the progress of the work of the various Canadian Engineering Standards Association Committees is periodically transmitted to the organizations doing similar work in other parts of the world. Similar information as to their own work being furnished by these bodies in return. In this way overlapping and duplication of work will be avoided, and data as to work already accomplished elsewhere in any subject can be readily applied for.

Specially close co-operation and consultation has taken place with the British Engineering Standards Association, and with the American Engineering Standards Committee in several instances, (gearing for example), members of our Committee have been invited to attend meetings of the American Engineering Standards Committee with very satisfactory results.

The sympathy and financial assistance of *The Engineering Institute of Canada* has been greatly appreciated by the Main Committee of the Canadian Engineering Standards Association; in many subjects, (as for instance, the important one of Concrete and Reinforced Concrete), it is felt that the two organizations must work hand in hand if the best results are to be obtained by either.

New Activities

During the last few weeks a number of important suggestions for activity have been received, among which may be mentioned one from the Automobile Club of Canada requesting the formation of a Committee to draw up, if possible, specifications for gasoline, which will be acceptable to, and used by the manufacturers, and one from the Dominion Highways Commission, asking for the organization of a Sectional Committee on Road Materials and Construction, with the view of obtaining the co-operation of the various Provincial Highways Authorities, engineers and contractors, in defining and specifying road materials and methods so as to avoid confusion and secure uniformity wherever possible in the requirements for this important work throughout the Dominion. *The Institute,* of course, is primarily interested in this work.

Progress

In some cases, progress by the working committees has been disappointingly slow, not from lack of willingness on the part of the chairmen and members, but because of the time necessary to ensure that all interests concerned actually receive thorough consideration of their proposals, and that these proposals are adequately criticized before adoption.

Our late Chairman

This year the Committee sustained a great loss in the death of its founder and President, Sir John Kennedy, Hon.M.E.I.C. Untiring in his interest and co-operation, his keen judgment and long experience were of very great value, and while we mourn his loss, we are thankful that such long years of service to the engineering profession and to mankind were his portion.

Secretarial Work

Your representatives cannot close this report without referring in the most complimentary terms to the highly efficient and indefatigable work of the General Secretary, R. J. Durley, M.E.I.C. The success so far attained by the Committee is, in no small measure, due to his unflagging interest.

Respectfully submitted,

WALTER J. FRANCIS,

Chairman.

Canadian National Committee International, Electro-Technical Commission

The President and Council,

On behalf of the Canadian National Committee of the International Electro-technical Commission, I beg to submit the following report for the year 1921.

The main activities of the Committee have been connected with the completion of the system of International Electrical Symbols, and also with the question of the adoption of names for the fundamental Electro-Magnetic Units. The latter subject was brought to the fore by the action of the Danish Committee in appealing, in connection with the centenary of the discovery of Electro Magnetism by Oersted, for this name to be given to one of the Electro-Magnetic Units.

This appeal brought expressions of views from most of the National Committee, and the matter is still under consideration.

The Committee hope to be represented in Paris at the International Conference on technical problems connected with high tension distribution by Major Edgcumbe.

Yours truly,

L. A. HERDT,
Chairman.

Civil Service Classification Committee

The President and Council,

The Civil Service Classification Committee has not been called upon for any action during the past year and consequently has had no meeting.

Respectfully submitted,

J. M. R. FAIRBAIRN,
Chairman.

Committee on Deterioration of Concrete in Alkali Soils.

The President and Council,

On behalf of the Committee on Deterioration of Concrete in Alkali Soils, I beg to submit the following report. An organization meeting of the Committee as originally constituted was held at the University of Saskatchewan, Saskatoon, Sask., April 23rd, 1921. A general discussion of the problem by the Committee members, all of whom have been familiar with the effect of alkali on concrete for several years, indicated that there was complete agreement as to the course which should be pursued in the investigation. Since previous investigations have established the fact that the best of Portland cement concrete may not prove permanent under certain known exposure conditions it was agreed that the main effort should be directed towards the chemical problems involved, including the constitution of cement and the chemical reactions between the soluble salts and the constituents of the cement. There is at present little to be gained by an extensive series of exposure tests of concrete to field conditions and it was decided to limit this phase of the investigation to a limited number of concrete specimens which would later serve as a basis of comparison with future field work which might be planned as a result of the findings of the chemical laboratory. It was further agreed that a physical chemist having the highest qualifications be obtained to direct and supervise the chemical research and steps were taken to survey the field of available men in that line of work. In order that the Committee might have the benefit of the advice and experience of a number of chemists of the Prairie Provinces who are familiar with the alkali-concrete problem, the appointment by the Council of *The Institute* of the following to full membership on the Committee was recommended:—

- Dr. J. W. Shipley, professor of chemistry, University of Manitoba.
- Dr. T. Thorvaldson, professor of chemistry, University of Saskatchewan.
- F. C. Field, city analyst, Calgary.
- A. G. Blackie, city analyst, Winnipeg.
- J. A. Kelso, provincial analyst, Edmonton.

The above were later designated as Committee members and have since taken an active part in the work of the Committee.

A second series of meetings of the Committee was held in Saskatoon, August the 10th to 12th, 1921, at the time of the Tenth General Professional Meeting. After thorough consideration of the names of available chemists, it was decided to ask Dr. Thorvaldson, a Committee member, to take charge of this chemical research, which he accepted subject to the approval of Dr. Murray, president of the University of Saskatchewan. Dr. Thorvaldson has been directing the work of several assistants during the past year in connection with certain phases of the alkali-concrete problem and it was felt that he would be in a position to take active charge with a minimum of delay. The University of Saskatchewan has since agreed to this arrangement and in addition to offering all of its available facilities to advance the progress of the investigation has freed Dr. Thorvaldson from all class work so that beginning with January, 1922 he will devote all of his time to the research.

A report of the contributors to the funds of the Committee was made as follows:—

Council for Scientific and Industrial Research.	$5000.00
Province of Saskatchewan	3000.00
City of Winnipeg	200.00
Province of Alberta	1000.00
Canada Cement Company, Ltd.	3000.00
Canadian Pacific Railway	1000.00
Total	$13,200.00

A detailed report of the present status of the Chemical research appears later.

Report of Field Tests — Summer of 1921.

Following out the intention of the Committee that a limited amount of field investigation be started during the summer of 1921, concrete block specimens for exposure tests were moulded in the Concrete Laboratory of the University of Saskatchewan for exposure to alkali soil waters at points in Alberta, Saskatchewan and Manitoba.

These specimen are cylindrical in shape, 7″ in diameter and 21″ long, moulded in sheet metal forms. Two qualities of concretes were employed, having strengths of approximately 1200 and 2500 pounds per square inch at 28 days. Canada and Super brands of Portland cement were used. Three different aggregates were used for each of the above cements and qualities of concrete, gravel used in commercial work in the vicinity of Winnipeg, Saskatoon and Strathmore, Alta. After preliminary tests of the cements and aggregates, batches of concrete were carefully proportioned and mixed by hand and test specimens were cured in moist air for 27 days after 24 hours of hardening in the forms. From each batch of concrete prepared, there were moulded not less than six large exposure cylinders, 3-6″ x 12″ compression test cylinders and two slabs for permeability tests of the concrete. All obtainable data such as characteristics of cement and aggregate and weights of each used were noted for further study.

In addition to plain concretes listed above, other batches were prepared using various waterproofing and alkali proofing compounds suggested by the Committee members and different manufacturers as well as "Commercial" cement, a natural cement manufactured near Winnipeg. Some waterproofings are of the integral type while others are liquids or bituminous coatings applied to the surface after curing is completed. Each batch of concrete moulded was given a series number. In all 28 series or batches were prepared. Before shipment all specimens were wrapped in heavy paper and crated separately for protection.

Shipments of 56 test cylinders, (28 series) were made to the following points early in September for exposure to Alkali conditions.

Cassils, Alta.:—One group was placed in a heavy alkalied tract of land near Cassils, Alta., in a locality which has been used for several years by the Department of Natural Resources, C.P.Railway for similar experiments.

Grandora, Sask.:—One group was placed along the shore line of a sulphate lake near Grandora, Sask., about 14 miles west of Saskatoon.

Winnipeg, Man.:—A group was placed along the Aqueduct of the Greater Winnipeg Water District at a spot where analyses showed the ground water concentration to be highest.

At Cassils, Alta., the ground water table is only slightly below the ground surface and the blocks were embedded with about 6″ projecting. At Grandora, Sask., the same scheme was employed. At Winnipeg the water table was found about 8 feet below the surface which necessitated the excavation of the soil to a depth of 8 feet in an area about 50 feet square.

A systematic method of securing samples of the alkali waters, during the period that the ground remains unfrozen has been adopted and the inspection of the condition of the individual blocks will be made at least twice yearly, in the spring and in the fall.

The Portland Cement Association is at present conducting extensive field experiments in the United States and is cooperating with the work of our Committee by furnishing groups of 82 blocks each for exposure at the above three points. These have been installed alongside our own blocks and will be given the same inspection. The Super Cement (America) Limited has also furnished a number of small test pieces made in their laboratory which have been placed with the large blocks.

Report on Chemical Research.

Since September three graduate students holding bursaries from the Honorary Advisory Council for Scientific and Industrial Research have been working on certain phases of the problem. The laboratory work so far done is of a preliminary nature concerned mainly with the action of the various salts under consideration on some of the simpler substances in cement and concrete. A considerable quantity of equipment specially adapted to this investigation has been ordered and is now being delivered. In September Dr. Thorvaldson made a trip to Washington, D.C., and conferred with the members of the Cement Division of the Bureau of Standards and the research workers in the Geographical Laboratory of the Carnegie Institution on questions relating to this investigation. The bulk of the advances so far made in America as to the constitution of cement has been accomplished at these two laboratories and it was therefore considered important to ascertain what work on this subject they proposed to continue and correlate our work with theirs. We look forward to a cordial cooperation with these institutions. To date difficulty has been encountered in obtaining a trained assistant for the petrographical work. This phase should be carried on along with physical, chemical and collodial examinations of the disintegration of concrete. In addition to the foregoing and the graduate students whose services will continue, additional assistance will be required and is now being arranged for, and the force of trained research workers will be increased as rapidly as the different phases of the investigation unfold during the next few months. As stated above Dr. Thorvaldson is now devoting his full time to conducting and carrying on the chemical investigation.

Respectfully submitted,

G. M. Williams,
Secretary.

Honour Roll and War Trophies Committee

The President and Council,

On behalf of the Honour Roll and War Trophies Committee I beg to submit the following report. During the past year your Committee has secured the nucleus of an exhibit of war trophies, which have been placed in a glass case at *The Institute* Headquarters. It is suggested by the Committee that members of *The Institute* who have trophies which they do not desire to keep, might donate them to *The Institute*, where they could be placed on permanent exhibition, and for which credit will be given the donor.

Through the efforts of your Committee, and after considerable negotiations, we were able to secure for *The Institute* a captured German field gun, which has been mounted on a concrete base alongside the Headquarters building, and which will stand as a lasting

monument of the part played by Canadian engineers in the late War. It is hoped that a suitable bronze tablet may be placed on this trophy to commemorate the gallant part taken by the many members of *The Institute* in every branch of overseas service.

Respectfully submitted,

CHARLES J. ARMSTRONG,
Chairman.

Committee on International Co-operation

The President and Council,

On behalf of the Committee on International Co-operation, I beg to submit the following report.

Your Committee reports a continuation of friendly fraternal relations between *The Institute* and the founder engineering societies of the United States. Following the policy previously adopted, members of *The Institute* have been encouraged to attend the annual conventions of the founder societies in which they are members. One member of this Committee, John Murphy, M.E.I.C., attended as an official delegate of *The Institute*, a Peace Dinner, given in New York on October 10th, in honour of distinguished British and European engineers.

The outstanding announcement of your Committee is to advise that successful negotiations have been completed with the American Society of Civil Engineers, and the American Institute of Electrical Engineers, whereby our members shall receive the publications of these Societies at the same price as their own members, following a similar arrangement made last year with the American Society of Mechanical Engineers, and the American Institute of Mining and Metallurgical Engineers, in return for the same courtesy extended by *The Institute.*

Respectfully submitted,

H. H. VAUGHAN,
Chairman.

Publicity Committee

The President and Council,

Enclosed herewith is a copy of a report prepared in June 1921 by your Committee on Publicity, consisting of Professor Peter Gillespie, M.E.I.C., of Toronto; J. B. Challies, M.E.I.C., of Ottawa; H. H. Vaughan, M.E.I.C., of Montreal, and the writer as Chairman. Since preparing this report, further discussions have taken place and correspondence passed amongst the members of the Committee, and with certain representatives of the technical press, in an endeavour to harmonize the very conflicting opinions expressed.

The members of your Committee are not unanimous in the opinion that the suggested regulations are the best that can be drafted, but the majority of the Committee feels that the suggested regulations will serve the present purpose well, at least until they will have been in force for some time to see how they work out in practice. With the amendment to the by-laws worded as it is in our report, it will be possible for Council to change the regulations as it sees fit from time to time to meet any requirements that may arise.

It is suggested by one member of our Committee that it might be well not to make the proposed regulations a definite ruling of Council until, first, they have been submitted to the various Branches for immediate consideration and advice, and second, they have been made the basis of a consultation between the Institute Committee and a Committee representing the Trade and Engineering Journals of Canada.

After two years' experience in this Committee work, the writer feels thoroughly convinced that no restrictive regulations which any committee could put out will be acceptable to the technical press, which apparently desires an absolutely free hand to gather news wherever and in whatever manner it can do so.

Your Committee feels that it has completed the work it was asked to do, and begs to be relieved of its duties.

Respectfully submitted,

FREDERICK B. BROWN,
Chairman.

The President and Council,

Your Special Committee on Publicity in connection with Institute Papers and Addresses have continued the work they have been doing during the past year and now beg to present their report covering the work done to date. A great deal of correspondence has been exchanged between the members of the Committee, and representatives of the technical press have been interviewed. We have come to the conclusion that it will be impossible entirely to satisfy the representatives of the technical press by imposing any restriction whatever on the publication of Institute Papers. We realize that a certain amount of publicity in the technical press is desirable, especially if proper acknowledgement of the author's standing as a member of *The Institute* be made with the publication of the paper, but on the other hand we feel that some restrictions are necessary in the interests of *The Institute* and the author himself.

A solution which appears to meet the case well is to amend the by-laws as follows, — delete clause 3 of section 22 and substitute for this clause the following, which would become a new clause 3 of section 21 of the by-laws.

"All papers, written discussions thereon, or communications accepted for presentation at any Branch, Provincial Division, General Professional, Annual or other meeting of *The Institute*, as "Institute Papers" shall be considered the property of *The Institute.* The publication of such papers shall conform to regulations issued from time to time by the Publication Committee

and shall be subject to their decision. Any paper which has not been accepted shall be promptly returned to its author."

You will note in the above proposed amendment that the proposed restrictions apply only to papers accepted as "Institute Papers." This gives considerable leeway in deciding whether a paper is of sufficient importance to hold for the Transactions or *The Journal*, and it would also save dignifying as an Institute Paper a mere address of no real importance or a subject of purely local interest. We would therefore suggest that the above amendment be issued temporarily as a ruling of Council, and an amendment in the by-laws made accordingly. This would place the matter on a proper footing and the following suggested regulations could apply and be changed from time to time as found necessary or desirable without any further change in the by-laws.

Your Committee suggests the following regulations:—

1.—No Institute paper shall be published without written consent of the Publication Committee of *The Institute* in advance of its presentation before *The Institute* except it be in a regular or special edition of *The Journal*. All papers published in *The Journal* in advance of being read at a meeting of *The Institute*, shall, after being read, be immediately available for publication elsewhere.

2.—Any Institute paper published in advance of presentation or in advance of its publication in *The Journal* unless with the written consent of the Publication Committee of *The Institute*, shall be ineligible for inclusion in the Transactions of *The Institute* or for competition for any of *The Institute* prizes or medals.

3.—Institute papers of general or purely local interest may, with the author's permission, be published anywhere immediately after being read.

4.—Institute papers descriptive of engineering work of a technical nature or of a general engineering or technical nature may be published other than in *The Institute*'s publications in abstract only, unless by special arrangement with the Publication Committee, such abstract to be made by the author or by a committee.

5.—All Institute papers shall be subject to editing and revision by the Institute Committee before publication in the Transactions. A paper so revised shall not be published in the Transactions without the consent of the author to the proposed changes.

6.—When necessary to publish a paper in abstract in *The Journal*, the author should be requested to furnish an abstract corresponding with the space available or to consent to the paper being abstracted by the Publication Committee.

7.—The author of any paper should be requested to submit with his paper a list of members of *The Institute* specially qualified to discuss his paper and the Secretary should call the paper particularly to the attention of these members and others locally known to him as likely to be interested in it, urging them to be present at the meeting at which the paper is to be presented and to join in its oral discussion.

8.—The printing of his own discussion should be optional with the speaker.

Respectfully submitted,

FREDERICK B. BROWN,
Chairman.

Roads and Pavements Committee

The President and Council,

I beg to submit the following report with respect to the work of the Roads and Pavements Committee for the Calendar year 1921.

The year 1921 has been a season of somewhat exceptional activity with respect to road construction and paving throughout Canada; so that the Chairman of this Committee experienced some slight difficulty in securing the prompt attention of members of the Committee whose services would be most valuable. It is anticipated, however, that with the foundation laid during the past year, very satisfactory results will accrue during the year 1922 with respect to the work carried on by this Committee.

The Committee has undertaken the task of preparing general specifications for various types of roads and pavements and has allocated the drafting of these specifications to various individual members as follows:—

A. F. Macallum, M.E.I.C.	—Block Pavements.
W. P. Brereton, M.E.I.C.	—Sheet Asphalt.
J. A. Duchastel, M.E.I.C.	—Macadam.
W. P. Near, M.E.I.C.	—Cement Concrete.
L. C. Charlesworth, M.E.I.C.	—Gravel.
W. A. McLean, M.E.I.C.	—Bituminous Penetration and Bituminous Concrete.

It is intended that the several specifications will be prepared with some degree of uniformity, based on the following outlines:—

1. *General Description.*
2. *Preparation of Subgrade.*
   - (a) Cleaning
   - (b) Shaping to grade
   - (c) Consolidating.
3. *Foundation.*
   - (a) Brief Description
   - (b) Dimensions
   - (c) Materials
   - (d) Method
   - (e) Cleaning.
4. *Binder Course (Cushion).*
   - (a) Brief Description
   - (b) Dimensions
   - (c) Materials
   - (d) Method.

5. *Top Course.*
   - (a) Brief Description
   - (b) Materials
   - (c) Method of Handling
   - (d) Finishing
   - (e) Joints.

6. *Seal Coat (Grouting).*
   - (a) Brief Description
   - (b) Materials
   - (c) Method of Handling.

7. *Shoulders.*
   - (a) Brief Description
   - (b) Materials
   - (c) Method of Handling.

Water-bound Macadam	Bituminous Macadam Penetration	Asphaltic Concrete Sheet Asphalt	Cement Concrete Surface or Foundation	Brick, Stone, Wood, Asphalt Block
General description	General description	General description	General description	General description
Preparation of sub-grade	Preparation of sub-grade	Preparation of sub-grade	Preparation of sub-grade	Preparation of sub-grade
Foundation	Foundation	Water-bound macadam, cement concrete	Foundation	Cement concrete
	. . .	Binder course	. . .	Cushion
Top course	Top course	Top course	Top course	Top course
. . .	Seal coat	Seal coat	. . . .	Grouting
Shoulders	Shoulders	Shoulders	Shoulders	Shoulders

Respectfully submitted,

W. A. McLean,
Chairman.

Committee On Uniform Steam Boiler Specifications

On behalf of the Committee I beg to report as follows on the progress made during the past year in having uniform boiler regulations adopted by the different provinces.

The regulations which the Committee recommend for adoption have been printed in pamphlet form and sample copies may be obtained from R. N. Blackburn, chief inspector of steam boilers, Regina, Sask.

These regulations have now been officially adopted by the different Provinces of Saskatchewan, Manitoba and Alberta.

The chief inspector of boilers for Ontario advises that sample copies of these regulations are being prepared for the consideration of the Minister of Labour for Ontario. It is expected that Ontario and British Columbia will adopt them at an early date.

The Department of Public Works of the Province of Nova Scotia has been supplied with copies of these regulations and is considering the advisability of adopting them.

Your committee hopes to bring the advantages of adopting these rules before the proper authorities in the remaining Provinces of Quebec, New Brunswick and Prince Edward Island, in the near future, in order that Canada shall have uniform boiler regulations in all the Provinces.

The membership of the Committee is as follows:— L. M. Arkley, M.E.I.C., Chairman, W. G. Chace, M.E.I.C., F. G. Clark, M.E.I.C., R. J. Durley, M.E.I.C., D. W. Robb, M.E.I.C., H. H. Vaughan, M.E.I.C.

Respectfully submitted,

L. M. Arkley,
Chairman.

Branch Reports

Victoria Branch

The President and Council,

On behalf of the Executive Committee I beg to submit the following report. I have pleasure in presenting for your consideration, some particulars of the work of the Branch during the past twelve months, which I trust be satisfactory, and meet with your approval.

Membership

Since the last annual meeting there have been a few changes in the membership of the Branch, which the following statement will make clear:—

Active members on present list

Members	25
Associate Members	41
Juniors	2
Students	3
Total	71

Changes

	Members	Assoc.Mem.	Gain	Loss
Died	–	1	-	1
Resigned	2	–	–	2
Left City	2	1	–	3
New Residents	4	3	7	–
Elected	–	2 1 Jr.	3	–
			10	6

Net gain of four.

Transfers

Only one transfer has been effected during the year, from Student to Associate Member.

Owing to the changed conditions affecting employment here, several members who are generally resident in Victoria have been away at other places during the greater part of the year.

Branch Activities

The activities of the Branch have comprised holding Regular Meetings, when Papers have been read and branch business conducted, luncheons at which either addresses on technical subjects have been delivered or some subject of general interest to the profession dealt with by different speakers.

In this regard I would mention that the Executive decided to invite all members of the Association of Professional Engineers who are not at present members of *The Institute*, to attend the lunches, and many have done so and have also expressed their appreciation for the consideration shown them.

Some of the papers and addresses which have been given dealt with the following subjects:—

Small Water Powers	J. B. Holdcroft, A.M.E.I.C.
Light Railways in France	H. Peters, A.M.E.I.C.
Electric Pumping for Irrigation	G. R. Alexander
Astronomy	Dr. Plaskett.
Wireless	F. P. Hill

Only one visit has been made during the year to the plant of Messrs. Yarrows Ltd., Esquimalt, but in the near future we hope to arrange for a series of visits to the new Dry Dock now under construction and also to the Dominion Govt. Astro-Physical Observatory.

Visitors

The Branch has been fortunate in that both the General Secretary of *The Institute*, Fraser S. Keith, and the President, J. M. R. Fairbairn, have visited the city in the year.

Mr. Keith was with us at lunch and also addressed the members at a regular meeting. We hope to have the pleasure of another visit some time during the coming year.

Unfortunately owing to the fact that he had only just previously recovered from a serious illness, the President was unable to meet the members collectively, but he did give a little of his time to discuss the affairs of *The Institute* with some members of your executive.

Branch members chosen for other positions

The Branch can congratulate itself in that several of its members have been chosen to act on different councils and committees. D. O. Lewis, M.E.I.C., formerly an active member of this Branch, and still considered as one of us, has been elected President of the Association of Professional Engineers of B. C. for the second time, and H. L. Johnston, M.E.I.C., our representative on the Council of *The Institute*, is also a member of the council of the same association of Professional Engineers.

P. Philip, A.M.E.I.C., has been appointed to act as provincial representative on *The Institute* Committee on Specifications for Good Roads. The appointment of a member to represent this branch on this committee is still to be made.

G. P. Napier, M.E.I.C., is a member of the Engineering Standards Committee on Steel Bridges.

Branch business

As indicating the relationship of the Branch to *The Institute* generally and to show the necessity for Branch organizations I would mention that during the period under review, not taking into consideration notices of meetings etc, about 460 letters have been received and

sent, dealing with such matters as legislation, remuneration, employment, applications for admission and transfer, and annual and professional meetings.

Journal

The Journal of *The Institute*, which shows continual improvement, now gives regularly in its pages some accounts of the work being done by this and other Branches. When any news of interest is available it is forwarded as a contribution to the Branch News, and the funds of the branch benefit to some extent from such copy.

It would be to the advantage of the Branch as a whole, as well as of interest to members individually, if items of news available for publication were forwarded to me for transmission to Montreal.

Branch dues

The question of the cost to members, of keeping up their subscriptions to various societies and keeping in touch with the technical literature published, is one calling for consideration. Apart from the fact that the remuneration of engineers is generally poor, it is quite expensive to be in the profession and keep up-to-date. I am of the opinion that this is the reason for the difficulty experienced in collecting Branch dues and also accounts for the absence from our meetings of some members. It would appear advisable that the question be given consideration.

In concluding I wish to express my thanks to the Chairman and members of the executive for their assistance and forbearance during this year, and the members for the readiness with which they have acted upon notices etc, and for their evident appreciation for my poor efforts.

Revenue

Fees from 1st Dec. 1920 to 30th Nov. 1921	$200.00	
Rebates from Engineering Inst. Montreal	211.36	
Interest on War Bond	2.75	
		$414.11

Expenditures

Rent of Room, 1st Nov. 1920 to 30th Nov. 1921	$260.00	
Postage Stamps	32.30	
Stationery	53.91	
Blue Prints	3.27	
Technical Papers	27.06	
Lectures (Rent of Hall)	5.00	
Socials and Dinners	4.00	
Commission on Cheques	.45	
Obituary Wreath (J. Mason, deceased)	4.50	
		$390.49
Excess of Receipts over Disbursements		23.62
Balance in Hand		$83.06

Liquid Assets:

Victory Bond	$99.11
Bank Balance	64.18
Cash	18.88
	$162.17

(Signed) E. P. Girdwood,
Treasurer.

The Books, Vouchers and Balance Sheet have been examined and found correct.

(Signed) E. P. McKie,
A. Long, Auditors.
December 8th 1921

Presented to the Annual Meeting of the Victoria Branch, December 14th 1921, and adopted.

Respectfully submitted,
H. M. BIGWOOD,
Secretary.

Vancouver Branch

The President and Council,

On behalf of the Executive Committee I beg to submit the following report.

Meetings

During the year 1921 the following meetings were held:—

Feb. 9—"**Town Planning**". Luncheon. Address by Thos. Adam, F.S.I. Attendance—45.

Feb. 25—**Water Supply Across the Sinai Desert for the Palestine Expeditionary Force**" Capt. T. W. Fairhurst, R.E., A.M.E.I.C. Attendance—60.

Mar. 24—**Luncheon. Address by S. L. Squire and Russel T. Kelley of the Canadian Good Roads Association** Attendance—50

April 8—**Dinner.** Guest, Fraser S. Keith, Secretary of the Institute. Attendance—39.

May 25—"**Administration of Vancouver Harbour**". Luncheon. Address by Lt. Col. Guy H. Kirkpatrick, D.S.O. Attendance—48.

June 8—"**Light Railways in France during the War**" Major W.G. Swan, D.S.O., M.E.I.C. Attendance,— 20.

Oct. 26—"**The Ballantyne Pier**" E. H. James, A.M.E.I.C., and Wm. Smail, M.E.I.C. Attendance—50.

On August 27th the Branch officers and those interested in paving work were the guests of the Provincial Public Works Department when the paving work on Lulu Island and in the Fraser Valley was visited. The Ballantyne Pier, the contractor's plant and yard were visited on 24th September.

The inauguration of luncheon meetings has proved a distinct success, both as regards the social side and the attendance, which was in excess of that at evening meetings. Difficulty has again been experienced in obtaining papers of sufficient interest to insure an attendance commensurate with the time for preparation and the cost of preparing slides.

The Executive Committee held eleven meetings during the year and two additional luncheon meetings.

Major Walkem and Professor Matheson attended the Western Professional meeting at Saskatchewan in August.

The Western Irrigation Convention held at Vernon was attended by two delegates from this Branch and a report on the proceedings was received from A. C. R. Yuill, A.M.E.I.C.

New Quarters

Considerable time was devoted to the obtaining of joint quarters. The new quarters in the Birks Building consist of four rooms, there being a general office, Board room, Secretary's Room, and Library. The following bodies are now housed in the new rooms: *The Institute*, the Association of Professional Engineers, The Architectural Institute of B.C., the B. C. Technical Association, Vancouver Sect. A.I.E.E., and the Chemical Society. The Library is undoubtedly better patronized since this arrangement was completed and its usefulness generally is much enhanced by the presence of Mr. Wheatley who has taken great pains to make the rooms as serviceable as possible. A valuable addition was made to the Library by Chas. Garden and the Branch is much indebted to Major Walkem for technical magazines.

British Columbia Technical Association

On 26th September the B.C.T.A. wrote this Branch requesting answers bearing on a suggested scheme whereby their members might join *The Institute*. This matter was very fully discussed by this Branch Executive and before an answer was drafted our President, Dr. Fairbairn, visited Vancouver, thus giving the Executive the viewpoint of Headquarters. The matter was then referred to Council and the reply received on 19th instant was submitted. The principle difficulties in the way of the scheme are the Association's request for the waiving of Entrance Fees and the difficulty some Technical Association members would meet with on account of lack of qualifications to enable them to gain corporate membership while their age might preclude them from entering in the junior grade.

It was a matter of very general regret that President Fairbairn was unable to meet the members at some general or social meeting, but he was scarcely recovered from a very severe illness, which caused him some anxiety while in the City.

Membership

It is rather difficult to compare the Branch membership year by year on account of the movement of Institute Members in B.C.

The present membership is:—

Members	51
Associate Members	86
Juniors	8
Students	11
Associate	1

During the year the Branch sustained a very great loss in the death of Messrs. F. F. Busteed, M.E.I.C., and W. J. Stuart.

Several members have left the Branch area. Major C.R. Crysdale A.J. Graham have gone to the Gold Coast, and Major LeR. Grant has gone to Kingston.

Several new members were admitted during the year and there have been additional members from other Branches.

Financial Statement

Branch Fees are provided for in the Branch By-laws, and of the 145 corporate and junior members only 44 have paid their current dues. Eight paid arrears for 1920. While admitting a multiplicity of fees, the proportion is exceedingly small.

The balance on hand is $209.16.

Branch News has brought in a very considerable sum, and it might bear repetition to state that this is a matter which the members should bear in mind. Matters of general interest and personal news should be sent to the Branch Secretary.

I wish to take this opportunity of thanking the Chairman, the Executive Committee and members for their help in my work, and to bespeak the same hearty co-operation for my successor.

J. N. Anderson,
Secretary-Treasurer.

Calgary Branch

The President and Council,

On behalf of the Executive Committee we beg to submit the following report for the period ending December 31st, 1921.

As our Branch year, previous to the amendment of the bye-law in January 1921, ended on November 30th, this report covers the period November 30th 1920 to December 31st 1921.

The first meeting was the Annual Meeting held on December 4th 1920 and the following officers were then elected:—

Chairman, G. N. Houston, M.E.I.C.,
Vice-Chairmen, P. Turner-Bone, M.E.I.C., G. W. Craig, M.E.I.C.,
Secretary-Treasurer, A. L. Ford., M.E.I.C.,
Executive Committee, F. W. Alexander, M.E.I.C., R. S. Trowsdale, A.M.E.I.C., C. C. Richards, A.M.E.I.C.
The appointed officers were:—
Assistant Secretary, J. J. Hannah, A.M.E.I.C.,
Auditors, F. K. Beach, A.M.E.I.C., W. J. Gale, A.M.E.I.C.,
Branch News Editor, F. K. Beach, A.M.E.I.C.

These officers under the new bye-law hold office until March 11th 1922.

In May Mr. Houston's official duties required his residence in Lethbridge and he resigned as Chairman, B. L. Thorne, M.E.I.C., being appointed to succeed him.

Mr. Hannah also moved to Lethbridge and was succeeded as Assistant Secretary by J. A. Spreckley, A.M.E.I.C.

Meetings

The executive held seventeen meetings at which the regular business of the Branch was transacted, special items being, the amendment of the bye-laws, compensation and remuneration of engineers, the function of the Provincial Institute of Technology now being erected in Calgary and the recommendation to the members of the

Provincial Government that a Highway Commission be appointed and that the engineering profession be represented thereon.

Fourteen general meetings were held at which there was on the whole a good attendance, a feature being the number of non members present at the open meetings.

The following is a list of these meetings:—

Dec. 4—"Annual Meeting".

Dec. 29—Special Meeting at Calgary Power House at which the members and the students from the University of Alberta were the guests of the City of Calgary. The subjects of the addresses were "**Electrical Distribution of the City of Calgary**", by R. A. Brown, M.A.I.E.E., City Electrical Engineer, Calgary. "**Cost of Operation of Power Plant**", by J. F. McCall, Chief Engineer Calgary Power Plant, and "**History and Purpose of The Engineering Institute of Canada**", by F. H. Peters, M.E.I.C., commissioner of irrigation, Calgary.

Jan. 21—"**The Lac La Range Expedition of 1920**", B. L. Thorne, M.E.I.C., mining engineer, Dept. of Natural Resources, C.P.R., Calgary. Smoker.

Feb. 4—"**Smokeless Powder**", G. N. Houston, M.E.I.C, Chairman of the Branch. Open Meeting with the Alberta Military Institute as guests.

Feb. 25—"**The Petroleum Situation**", Dr. J. A. Allan, University of Alberta, Edmonton. Open Meeting.

Mar. 3—"**Discussion of Report of Committee on Compensation and Remuneration**", P.J. Jennings, M.E.I.C, Chairman. Regular Meeting.

Mar. 18—"**Concrete**", Prof. G. M. Williams, M.E.I.C., of University of Saskatchewan, Saskatoon. Open Meeting.

April 1—"**Discussion of Amendment of Bye-laws**", Regular Meeting.

April 15—"**Dinner**". Gen. Secretary, Fraser S. Keith was guest of the Branch.

Oct. 4—"**Recent Developments in Concrete**", Lt. Col. Boyden, M.Am. Soc. C.E., of Chicago. Open Meeting.

Oct. 18—"**Special Luncheon**". Dr. J. M. R. Fairbairn, President of the Institute was the guest of honor.

Nov. 18—"**Engineering and Publicity**", C. O. Smith, editor of the "Herald" Calgary. Regular Meeting.

Dec. 2—"**Contracts in Relation to Corporations**", Alexander Hannah, Calgary. Regular Meeting.

Dec. 30—"**Annual Dinner**". P. L. Naismith, manager of the Dept. of Natural Resources, C.P.R., Calgary, R. B. Baxter, supt. of Alberta Government Telephones, Edmonton, Prof. R. S. L. Wilson of the University of Alberta, and the Students of the Provincial University were the guests of honor.

The Branch is indebted to the several speakers for contributing to the success of the programme and to the Programme Committee for the excellent entertainment provided and to the press of Calgary for its co-operation.

During the year F. H. Peters, M.E.I.C., a past chairman and very active member was lost to the Branch through his transfer to Ottawa. A. S. Dawson, M.E.I.C., who has always taken a very keen interest in the welfare of the Branch has been honoured by an appointment to the Senate of the University of Alberta.

Membership

The present Membership of the Branch is as follows:

28 Members
65 Associate Members
6 Juniors
4 Students
2 Associates
8 Affiliates of the Branch.

Total 113

During the year the gain in Membership to the Branch was:—

1 Member
17 Associate Members

and the loss in the lower grades:—

1 Junior
1 Student
1 Affiliate

Net gain 15

In the above statement the Members of the Calgary Branch who are now transferred to the newly formed Lethbridge Branch are shown as belonging to the old Branch. They will be written off our lists with the beginning of the new year.

This will decrease the number of full Members by four and Associate Members by three. It is to be noted however, in spite of this loss, that the Calgary Branch is entering 1922 with 106 members which is a stronger membership than at any time previous to 1921.

On behalf of the Calgary Branch we wish to express our best wishes for the success of the young branch which is, so to speak, our offspring.

The excellent condition as to membership is equalled by the splendid financial position of our Branch. The following statements are proof of this.

Financial Statement

Revenue

Balance on hand Dec. 1st, 1920	$620.22
Rebates for Parent Institution	215.44
Branch News	70.84
Interest from Bonds	31.28
Interest on Savings Account	4.84
Dues from Affiliates	3.00
Subscriptions to Special Meetings	12.00
	$957.62

Expenditures

Purchase of Bonds	$422.68
Payment of Outstanding Acct. for Banff Meeting	30.95
Expenses of Representative to Edmonton	21.60
Expenses of Meetings, Speakers, Travelling Expenses, Refreshments, etc	85.75
Flowers, etc	25.00
Mimeographing Bye-laws	25.50
Printing notices, etc	31.46
Stationery, postage, steno, etc	76.55
	$719.49
Balance on hand Jan. 1st, 1921	238.13
Total	$957.62

Assets

Balance in Bank, Jan. 1st, 1922	$238.13
Victory Bonds (3—$100) as per statement of 1920	286.50
Victory Bonds (1—$100) purchased in 1921	95.50
City of Calgary Bond (1—£100)	327.18
Increment in value of Bonds in 1921	65.94
Rebate dues from Parent Institute	23.94
Branch News Rebates due	10 70
Total Assets	$ 1047.89

Liabilities

Total Liabilities	"Nil"

Audited and found correct,

F, R. BEACH,
W. J. GALE.

Respectfully submitted,

B. L. THORNE,
Chairman.

ARTHUR L. FORD,
Secretary-Treasurer.

Edmonton Branch

The President and Council,

On behalf of the Executive, we beg to submit the 1921 Annual Report covering the activities of the Edmonton Branch .

Membership

Members	8
Associate Members	44
Juniors	4
Students	3
Associates	1
	60

Six general, and seven executive meetings were held during the year. The early meetings were taken up largely with discussion relating to the classification and remuneration of engineers.

Two technical papers of general interest were read during the year, one by Prof. G. M. Williams, M.E.I.C., on "A logical method for determining the Concrete-making value available aggregate and its practical application to production of concrete in the field". The second paper was an illustrated paper on the "Geological investigations made in the Fort Norman area of the McKenzie River Basin", by F. H. Link, Imperial Oil geologist.

The Branch had a cash balance on hand December 31st, 1921, with accounts all paid, of $69.87.

The officers for the year were:—

Chairman.............D. J. Carter, A.M.E.I.C.
Vice-Chairman.........A. W. Haddow, A.M.E.I.C.
Secretary-Treasurer.....C. C. Sutherland, A.M.E.I.C.
Executive:.............R. W. Ross, A.M.E.I.C.
J. D. Robertson, A.M.E.I.C.
E. Kells Hall, A.M.E.I.C.
Prof. R. S. L. Wilson, A.M.E.I.C.

The officers elected for the year 1921 and 1922 were:—

Chairman.............C. A. Robb, A.M.E.I.C.
Secretary-Treasurer.....R. H. Douglas, A.M.E.I.C.
Executive:.............Lt.-Col. Reid, M.E.I.C.
R. W. Jones, M.E.I.C.
H. H. Tripp, A.M.E.I.C.
C. F. Corbett, A.M.E.I.C.
A. G. Stewart, A.M.E.I.C.
Ex-Officio..........D. J. Carter, A.M.E.I.C.

Respectfully submitted,

C. A. ROBB,
Chairman.

R. H. DOUGLAS,
Secretary-Treasurer.

Lethbridge Branch

The President and Council,

On behalf of the Executive Committee I beg to submit the following report.

Following the granting of the petition for the formation of the Lethbridge Branch a meeting was held on Dcember 3rd to complete the organization and for the election of officers, the following being elected:—

Chairman, S. G. Porter, M.E.I.C.,

Secretary-Treasurer, C. M. Arnold, M.E.I.C.

Executive Committee:

G. N. Houston, M.E.I.C.,

C. D. Mackintosh, A.M.E.I.C.,

H. W. Meech, A.M.E.I.C.

The Branch starts off with a corporate membership of seventeen and one junior with four probable corporate members additional being now dealt with.

Subsequently the Executive Committee discussed plans for the Branch promising an active winter of meetings to start after the New Year.

Respectfully submitted,

C. M. ARNOLD,
Secretary-Treasurer.

Saskatchewan Branch

The President and Council,

On behalf of the Executive Committee we beg to submit the following report for the calendar year 1921. As the Branch year ends on February 28th., the period covered by this report refers to part of two Branch years, the activities of which were controlled by different Executives.

The outstanding feature of this year's programme was the Western Professional Meeting held at Saskatoon August 10th. to 12th., inclusive, which was carried out to a successful conclusion under the auspices of the Saskatchewan Branch. As full reports of the Meeting have appeared in *The Journal* little remains to be said but we wish at this time to express the appreciation of this Branch to the various Western Branches who helped to make this Meeting such a pronounced success.

While much more might have been accomplished, 1921 has been a banner year for the Saskatchewan Branch. The membership shows a satisfactory increase as may be seen from the attached statement, there being an increase of 19.3% of the total membership. Finances are in a healthy condition as may be seen from the statement covering the period from March to December 31st. 1921.

The Branch meetings have been well attended when it is considered that our membership is scattered throughout the whole of the province making it impossible for the majority of the members to attend many meetings. The social event of the year was a dinner dance held in February to which the outside members were guests of the Regina members, and it was pronounced by all to be well worth making an annual event. During 1921 nine regular and special meetings have been held, the majority of which were preceded by a Dinner at 6.30 P.M. The average attendance for the meetings was thirty-two particulars of which are as follows:—

Jan. 13—"Bridges", A. P. Linton, A.M.E.I.C.
Feb. 10—"Dinner Dance".
Mar. 8—Annual Meeting.
April 22—Address on "Society Affairs", Fraser S. Keith, M.E.I.C., General Secretary.
July 20—"The Manufacture and Use of Reinforced Concrete Pipe for Water Supply", W. G. Chace, M.E.I.C. Illustrated Lecture on.
Sept. 29—"Recent Developments in Concrete", Lt. Col. H. C. Boyden, M.A.S.C.E. Illustrated Lecture on.
Oct. 13—"Publicity", R. N. Blackburn, M.E.I.C.
"Classification", H. S. Carpenter, A.M.E.I.C.
"Remuneration", J. McD. Patton, A.M.E.I.C.
"Engineering Profession", H. R. Mackenzie, A.M.E.I.C.
Nov. 10—"Some Notes on Street Railway Operation", D. W. Houston, A.M.E.I.C.
Dec. 8—"The Practice and Principles of Taxation", L. A. Thornton, M.E.I.C.

While the Branch was disappointed in not being successful in securing legislation at the last Session of the Provincial Legislature we hope for better results in the near future. An active Legislation Committee have the matter in hand and the Legislature is now in Session.

A visit from our President, J. M. R. Fairbairn, M.E.I.C., was looked forward to with considerable interest as it was hoped that conditions would allow him to stop over while in the west last fall. Unfortunately through a series of unavoidable circumstances he was only able to meet a few of the members as he was passing through after having been hurriedly called East.

Membership

Membership Record Saskatchewan Branch 1921.

	Membership Jan. 1, 1921	New Members	With-drawals	Membership. Dec.31,1921
Members	19	2	–	21
Associate Members	69	20	4	85
Junior Members	9	3	1	11
Student Members	10	2	1	11
Associates	1	1	–	2
Branch Affiliates	6	1	1	6
Totals	114	29	7	136

Applications pending 7.

Financial Statement

Saskatchewan Branch March 1st. to December 31st. 1921.

Revenue

Bank Balance March 8th, 1921	$272.82
Saskatchewan Branch Dues	203.00
Rebates from Headquarters Jan. to Sept. Inc	171.43
Western Professional Meeting	215.65
Advertising, Stationery, Printing, Postage	95.00
Meetings	100.50
Sundries	13.00
	$1071.40

Expenditures

Saskatchewan Branch Dues	$ 13.00
Rebates to Headquarters	16.18
Western Professional Meeting	268.03
Advertising, Stationery, Printing, Postage	149.22
Meetings	139.25
Sundries	19.86
Honorarium to retiring Secretary-Treasurer	150.00
Scholarship to Saskatchewan University	100.00
To Bank Balance December 31st, 1921	215.86
	$1071.40

Assets

Cash in Bank December 31st, 1921	$ 215.86
Outstanding Saskatchewan Branch Dues	287.50
Outstanding Rebates from Headquarters	96.67
Furniture and Library	50.00
	$ 650.03

Liabilities

Accounts payable	$ 50.85
Surplus	599.18
	$ 650.03

Respectfully submitted,
W. R. WARREN,
Chairman.
D. A. R. MCCANNEL,
Secretary-Treasurer.

Winnipeg Branch

The President and Council,

On behalf of the Winnipeg Branch we beg to submit the following Report for the year 1921:—

Membership

Our membership has increased from 295 to 316, being an increase of 7.1%. The membership is distributed as follows:—

Members	50
Associate Members	168
Juniors	32
Students	35
Associates	5
Local Affiliates	26
	316

It will be noted by comparison with last year's report the increase is almost wholly due to the increase in Student Membership.

The following have been removed from the jurisdiction of this Branch through change in the location of the practice of their several professions:—

Members:—E. Brydone-Jack, F. L. Butler, G. H. Burbidge, W. J. Dick, F. H. Farmer, G. H. Herriot, W. M. MacPhail, A. W. Smith and J. M. Street.

Associate Members:—F. X. Amoss, C. K. Brown, C. F. Gray (temporarily).

Juniors:—H. V. Carman.

It is with regret that we record the loss of one of our esteemed members by death, Byron Hallock.

Meetings

The Branch has held sixteen meetings during the year, as follows:—

Date	*Subject*	*Speaker*	*Attendance*
1921			
Jan. 6	The Economics of the Transportation and marketing of the Canadian Wheat Crop	W. Sanford Evans	51
Feb. 3	Publicity	James Quail	31
Feb. 17	Highway Bridges in Manitoba	P. Burke-Gaffney.	72
Mar. 3	Electricity for Domestic Heating	E. V. Caton	85
Mar. 17	House Heating in Western Canada	G. R. Pratt	62
April 7	Regulation of the Winnipeg River	C. H. Attwood	84
April 28	The Electrical Furnace in the Industrial Field	F. H. Martin	74
	—Conservation of Energy—(Satirical)—	Wm. C. Taylor	
May 5	Annual Meeting		53
Sept. 1	Report of Western Professional Meeting	Prof. J. N. Finlayson, M. A. Lyons, W. M. Scott	34
Sept. 15	Searching for Oil in the Canadian Arctics	Chester Bloom	61
Sept. 28	Concrete Roads and Pavements	H. C. Boyden	46
Oct. 20	The Mall	Harold Edwards, G. B. McColl	60
Nov. 3	Ethics of the Engineering Profession	Prof. R. C. Lodge	48
Nov. 16	Town Planning	W. C. Hobbs	38
Dec. 1	PulpandPaperManufacture —Illustrated by Films of Price Bros. Operations	D. A. Ross	68
Dec. 15	Foundations in and Around Winnipeg	Harold Edwards, P. Burke-Gaffney.	88

The average attendance at regular meetings held during the year was 60, being an increase of 7 over that of last year.

Last April the Branch was favoured by a visit from the General Secretary. During his stay he imbued the members with interest in the affairs of *The Institute.* He addressed the regular meeting on April 28, and spoke at a luncheon in his honour held at the Fort Garry on April 29. General comment is to the effect that there should be more visits from Officers of *The Institute.*

The Branch has taken considerable interest in civic problems, the most important being the considerations affecting the proposed Mall. A special committee was struck to assist the Mayor with advice on problems arising out of negotiations.

W. E. Hobbs, A.M.E.I.C., was appointed commissioner of town planning for the Province.

Financial Statement

Revenue

Receipts from Local Dues Collected during the Year amounted to		$ 741.50
Rebates from Main Society — Three quarters		401.32
Branch News		47.79
Advertising		52.50
Bond Interest		27.50
Current Interest		4.73
Total		$ 1275.34
Cash in Bank at December 31st, 1920		91.07
		$ 1366.41
Expenditures		982.49
Cash on hand		$ 383.92
Cash in hand	$ 27.00	
Bank Balance	356.92	
Total	$ 383.92	

Assets

Cash Balance	$ 383.92
Rebates Last Quarter	62.75
Local Dues in Arrears	116.00
Victory Bonds	500.00
Office Furniture and Library	378.50
Total	$ 1441.17

Liabilities

Accounts Payable	$ 20.50
Surplus	1420.67
	$1441.17

Respectfully submitted,

GEO. L. GUY,

Secretary-Treasurer.

Ontario Provincial Division

The President and Council,

On behalf of the Ontario Provincial Division, and pursuant to the direction of By-Law No. 63, we beg to submit the following report for the calendar year 1921.

1.—The Membership of the Division consists, in accordance with *The Institute* By-Laws, of all the members of *The Institute* that are resident in Ontario. The total is approximately 1650, divided about as follows, viz:—

Corporate Branch Members	945
Non-Corporate Branch Members	450
Corporate Non-Resident Members	165
Non-Corporate Non-Resident Members	100
	1650

2.—The Executive Committee of the Division consists of the following, in accordance with the Division By-Laws, viz:—

The Ontario Councillors. (Nine)

The Honorary Councillors resident in Ontario. (Two)

One Representative from each Branch. (Eight)

One Representative per 25 Non-Resident Corporate Members. (Six)

The immediate Past Chairman of the Division.

The immediate Past Secretary-Treasurer of the Division.

A detail list of the personnel is contained in each month's issue of *The Journal.*

3.—The Executive Committee has held two meetings during the year, with an average attendance of 12 members, copies of all Minutes being duly forwarded to Council, as called for by *Institute* By-Law No. 63. In addition to the business transacted at the above meetings a considerable amount of detail has been attended to in the course of the year by correspondence.

4.—The most important question with which the Division Executive has been concerned during the year is that of a Professional Engineering Act for the Province of Ontario. To handle this question, as we reported last year, late in 1919 the Division joined with:—

The American Institute of Electrical Engineers, Toronto Section.

The American Society of Mechanical Engineers, Ontario Section.

The Association of Ontario Land Surveyors.

The Canadian Institute of Mining and Metallurgy.

The Canadian Society of Chemical Industry, and

The Ontario Association of Architects,

in forming a combination committee, known as the Advisory Conference Committee, and consisting of two representatives from each of the seven subscribing bodies. Later on the Architects withdrew their membership, thinking it would better suit their needs if a separate Architectural Act were introduced by them, which has since been done. The balance of the Advisory Conference Committee prepared a draft Bill, a copy of which is enclosed, amended to date, and had it introduced in the Ontario House in April last. Shortly after it was referred to a Special Committee thereof for consideration and report, together with the Architectural Bill, but before the Committee had time to report the House adjourned. The work however is actively in hand in preparation for next session, when it is trusted that the Advisory Conference Committee, backed by all the members of its constituent organizations, will succeed in getting a bill through.

5.—In this connection we would like to express the Division's appreciation of the action of the Toronto Branch Executive in forming itself into a local Committee to assist the Division representatives on the Advisory Conference Committee with their part of the work. There is a tremendous amount of detail to be attended to, and the advice and assistance of such a local committee will undoubtedly be a great help.

6.—Further, we would like to emphasize again the great value of such a body as this Advisory Conference Committee as not only the best means of handling any matter affecting a number of professional organizations, but also as the best possible method of bringing such organizations together in a way that gives each and all of them the most complete understanding and appreciation of the aims and methods of each of the others.

7.—Re finances, thanks to the kindness of Council in advancing us the sum of $400.00, coupled with the fact that up to date the outlay regarding legislation has not been as large as was anticipated, our financial situation has not been as difficult this year as it was during 1920. At date, assuming that all accounts were cleared away, both actual and prospective, we would have a cash balance of about $10.00. A copy of the statement presented to our last Executive meeting is enclosed herewith.

Financial Statement

Revenue		
Credit Balance at January 1st	$ 11.07	
Subscription, Col. Leonard	100.00	
Subscriptions, Sundry	6.00	
Rebate re Journal Article	3.89	
Loan from Headquarters	400.00	
		$ 520.96
Expenditure		
Advance to Advisory Conference Committee	$ 100.00	
Printing	30.00	
Stenography	20.00	
Postage	14.00	
Expenses re Meetings	8.00	
Telephone, Telegraph, etc.	15.17	
	$ 187.17	
Balance on hand	333.79	
		$ 520.96
Asset		
Rebate due from Advisory Conference Committee	$ 125.00	
Cash on hand	333.79	
		$ 458.79
Liabilities		
Headquarters Loan	$ 400.00	
Sundries, estimated	50.00	
		$ 450.00
Balance		$ 8.79

8.—Lastly, we would like to take this opportunity of expressing, on behalf of all the Ontario members of *The Institute* outside of Toronto, their sincere appreciation of the Professional Meeting arranged and financed by the Toronto Branch in February last. It was exceedingly much enjoyed by all those attending, both professionally and personnally, great credit and many thanks are

due to each and all of the members of the Toronto Branch for the very fine programme they presented and the excellent way in which it was carried out.

Respectfully submitted,

W. H. WAGWOOD,
Chairman.

W. A. MCLEAN,
Vice-Chairman.

A. B. LAMBE,
Secretary-Treasurer.

Sault Ste. Marie Branch

The President and Council,

I beg to submit herewith the Annual Report of the Sault Ste. Marie Branch for the year ending December 31st, 1921.

Membership

The past year has seen the Branch membership increase from twenty-two to twenty-nine. Eleven new members were elected to membership in the E.I.C. within our district and there were four removals, making an increase of seven.

During the early summer an aggressive membership campaign was started here and our efforts were brought to a focus at our First Annual Dinner held at the Country Club, June 28th. Over forty guests and members were present. The President of *The Institute*, J. M. R. Fairbairn, M.E.I.C., and the Secretary, Fraser S. Keith, M.E.I.C., were the guests of honour. All engineers resident within our district were invited to be present. Those who were not already members of the E.I.C. had previously been approached with a view to securing their applications for admission. We have not a large field to work upon, and the resulting increase of eleven members is a creditable showing. There are still a number of applications pending. Our policy is to bring into *The Institute* as Associates men holding executive positions in the engineering and allied industries when their occupations come within the scope of *The Institute's* objects.

Financial Statement

The Branch statement of receipts and disbursements for the year ending December 31st 1921, is as follows:—

Balance on hand, Jan. 1st, 1921...........		$ 80.33
Revenue		
Rebates from H-Q. on Members' Dues....	$ 43.75	
Affiliates Dues..........................	3.00	
Receipts from Journal for Branch News....	8.34	
Subscriptions to Annual Dinner...........	85.00	
Dinner photographs sold to members at cost	16.50	156.59
		$ 236.92
Expenditures		
Meetings and General Expense............	$ 47.30	
Annual Dinner expenses..................	155.75	203.05
Balance on hand, Dec. 31st, 1921....................		$ 33.87
Assets		
Cash:—In Treasurer's hands..............	$ 12.44	
" In Current Account, Royal Bank..	21.43	
		$ 33.87

[illegible]

None.

Meetings

The Officials of the Algoma Steel Corporation have very kindly placed their Board Room at our disposal for a place of meetings. Use was made of it nine times during the past year. Two meetings were held in other places, as noted in the following program of meetings held during the year.

- Jan. 6—**Discussion of the Draft Bill respecting Professional Engineers in Ontario.**
- Jan. 26—**"Decay in Timber,"** G. L. Durgin, research engineer with the Spanish River Pulp & Paper Co.
- Mar. 3—**"The Oxidation of Coal in Storage Piles,"** Wm. Seymour, M.E.I.C., illustrated with stereopticon views, and held in the Steel Plant Club.
- Mar. 24—**"Results of an Explosion in a Blast Furnace and the Methods adopted to Repair the Damage, and to Prevent a Recurrence of Another,"** B. E. Barnhill, M.E.I.C.
- April 28—**Motion Picture, "From Spruce to Newsprint,"** loaned by the Spanish River Pulp & Paper Co., exhibited in St. John's Hall.
- May 26—**"Mining Methods in Algoma,"** Geo. Cowie, Superintendent of Dept. of Mines, Algoma Steel Corporation.
- June 30—**Annual Meeting of Branch.**
- Sept. 29—**"The Construction of the Algoma Central and Hudson Bay Railway,"** R. S. McCormick, M.E.I.C.
- Oct. 27—**"Handling of Steel Plant Raw Materials,"** Carl Stenbol, M.E.I.C.
- Nov. 24—**"Relationship between Engineering and Financing in a Large Corporation,"** E. Carey, Comptroller of the Algoma Steel Corporation.
- Dec. 15—**Discussion on "Proposed St. Lawrence Canal and Power Development",** led by J. W. LeB. Ross, M.E.I.C., and G. H. Kohl, A.M.E.I.C.

The local press has shown much interest in our activities and publishes full reports of our meetings, including summarized accounts of the papers read.

Although our Branch is not numerically large, considerable discussion has been aroused at our meetings and an effort is being made by our Papers and Publicity Committee to submit papers of more general interest than in the past, on account of the diversified interests of our members. The attendance at meetings has been encouraging and men of affiliated callings are becoming interested in our attitude on engineering matters as is evidenced by the number who attend as guests. We have a fairly large field to draw on in the local steel, pulp and paper and power industries. A programme has been outlined for the winter and spring that we think will prove of increasing interest to our members and affiliates.

Public Interests

A Committee on Town Planning has been formed for the purpose of studying Town Planning principles and legislation, particularly with reference to their application to the city of Sault Ste. Marie. It is our intention to stimulate public interest in the Sault in a City Planning movement. Already we have secured the promise of cooperation and support from a number of local public bodies.

Respectfully submitted,

F. THEO. GNAEDINGEK,
Secretary-Treasurer.

Border Cities Branch

The President and Council,

The Executive of the Border Cities Branch beg to submit the following Annual Report for the current year, ending December 31st, 1921.

Meetings

Regular meetings held	8
Special meetings held	1
Average attendance	20
Executive meetings held	8
	37

Date	Subject	Speaker
Jan. 14	Super Cement	Capt. F. M. Dawson, A.M.E.I.C.
Feb. 11	Engineering Education	Prof. T. R. Loudon, M.E.I.C.
April 15	Richibuctu Breakwater	Major A. A. Anderson, Jr.E.I.C.
May 13	Park Scheme for the Border Cities	J. B. C. Keith, A.M.E.I.C.
Oct. 14	Steel Plants	W. H. Baltzell, M.E.I.C.
Nov. 17	Hydro	O. M. Perry, M.E.I.C.

Paper presented to **Journal** by D. A. Molitor, M.E.I.C., on **Metric System.**

The Border Cities Branch has had an active year, and has been regularly represented at the Ontario Provincial Division, and at the Annual Meeting of *The Institute.*

The average attendance has shown twenty-five percent increase over the year 1920 and the finances of the Branch show considerably better, in that we have a balance in the bank on December 31st, 1921, of $126.31, as against a balance on hand December 31st, 1920, of $31.50.

While the Branch has suffered a severe set back in membership this past year, from the fact that thirteen members have moved to points outside the Branch jurisdiction, through the efforts of your Membership Committee and Executive, our membership is greater than one year previous by 6%. Indications also point to further increase in the next few months.

The executive has met regularly throughout the year for the transaction of *Institute* business.

Report of Membership Committee

Members removed from Branch Jurisdiction:—

Members	2
Associate Members	7
Junior Members	3
Student Members	1
Total	13

Members Moved within Branch Jurisdiction:—

Members	0
Associate Members	3
Junior Members	1
Student Members	4
Total	8

Admission to Institute Membership:—

Members	3
Associate Members	2
Junior Members	5
Total	10

Transfers to Higher Grades:—

To Associate Membership	2
Total	2

Removed from Institute Membership by Council, March 22nd, 1921:—

Junior	1
Student	1
Total	2

Membership

1920

Members	11
Associate Members	32
Junior Members	8
Student Members	2
Total	53

1921

Members	13
Associate Members	29
Junior Members	9
Student Members	5
Total	56

Net gain in membership: 3.

Report of Ontario Provincial Division Representative
(To Branch at Annual Meeting)

There has been no meeting of the Ontario Provincial Division since my appointment. Very few letters have been exchanged between the Secretary of the Division and myself. A meeting has been called, to be held in the Engineers' Club, Toronto, on the 17th inst. The agenda consists of:—

1. Reading and confirming minutes of last Annual Meeting.
2. Financial statements.
3. Report on Ontario Engineering legislation situation.
4. Draft division report as called for by *Institute* by-law No. 63.
5. New business.

Section 3 seems to be the only one calling for special attention, and as H. B. R. Craig, M.E.I.C., our past chairman, is one of the division representatives, I think he will be able to give this subject full consideration and hence do not think it necessary to go to Toronto for the meeting, unless something new developes.

Report of Advertising Committee

The securing of advertising is worthy of the energies of any Branch and when vigorously pursued is a direct source of revenue. Industrial conditions in the Border Cities, in keeping with other centres, did not reach the high level shown in the immediate preceding years and this had a definite bearing on advertising appropriations. The territory was covered by a special representative of *The Journal* of *The Institute* this year but we hope that the incoming year will see a more aggressive policy pursued by the committee in charge than was in evidence last year.

Financial Statement

Revenue

By Balance Bank		$ 31.50	
By Rebate of Headquarters:—			
Membership Refund	$ 112.63		
Branch News	25.87		
		138.50	
By Receipts Special Dinner (April)		37.00	
By Bank Interest		3.20	
By Rebate due from Headquarters to Dec. 31:—			
Membership	2.00		
Branch News	8.80		
		10.80	
Total Receipts			$ 221.00

Expenditures

To Notices and Printing		$ 16.63	
To Typing, etc		6.10	
To Telegrams, Telephone		3.52	
To Exchange on Cheques from Headquarters		.40	
To Postage		7.97	
To Special Meeting Dinner (April)		39.45	
To Cigars, etc., Oct. Nov. and Dec. Meetings		9.82	
Total Expenditures		$ 83.89	
To Balance on Hand in Bank		126.31	
To Rebate due from Headquarters to Dec. 31:—			
Membership	$ 2.00		
Branch News	8.80		
		10.80	
Total			$ 221.00

Respectfully submitted,

A. J. Riddell,
Chairman.

J. E. Porter,
Secretary-Treasurer.

London Branch

The President and Council,

On behalf of the Executive Committee I beg to submit the following report:—

The initial proceedings to form London Branch were taken on October 20th, the preliminary meeting being called by H. B. R. Craig, M.E.I.C., and H. A. Brazier, A.M.E.I.C. On October 26th, a general meeting of all engineers in the district was held at Tecumseh House to discuss the formation of the Branch and it was unanimously decided to proceed with the organization, the committee charged with this work having H. B. R. Craig, M.E.I.C., as Chairman, and Colonel E. I. Leonard, M.E.I.C., as Secretary.

Following authorization by Council the organization meeting was held on November 16th; a full report of this meeting has been published in *The Journal.* The executive elected for the balance of 1921 was as follows:—

Honorary Chairman, Dr. J. Davis Barnett, M.E.I.C.
Chairman, H. A. Brazier, A.M.E.I.C.
Vice-Chairman, W. J. Forbes-Mitchell, A.M.E.I.C.
Secretary-Treasurer, Geo. C. Wright, A.M.E.I.C.

Executive Committee:— F. A. Bell, Jr., A.M.E.I.C., Chas. Talbot, A.M.E.I.C., F. J. Ure, A.M.E.I.C., A. H. Smith, M.E.I.C.

A regular meeting was held on December 21st. The report of this meeting will be found in the Branch News Section of the Section of the February *Journal.*

Respectfully submitted,

Geo. C. Wright,
Secretary-Treasurer.

Niagara Peninsula Branch

The President and Council,

On behalf of the Executive Committee we beg to submit the third annual report of the Branch.

Meetings

During the year the Branch has held six general meetings, three executive meetings, two trips of inspection and a dance. Four speakers addressed the Branch, one meeting concerned legislation for the Province of Ontario and in May the Annual meeting marked the Branch's third birthday.

This year's Executive have decided that a meeting should be held once a month during the Fall and Winter and that these should always be dinner meetings and held alternately in St. Catharines and Niagara Falls. The two meetings held this season and one last season seem to have shown the wisdom of this decision because the attendance and general enjoyment of the dinner meetings is much more marked than otherwise. Another new feature is the introduction of a song sheet at the dinner meetings under the able direction of Messrs. Frost and Blanchard.

Legislation

The principal item of business before the Branch during the year has been the question of legislation for Ontario. In March a general meeting was called to discuss this matter and with the assistance of the Branch legislation committee and one of the members of the Advisory Conference Committee, a thorough explanation was made of the Bill Respecting Professional Engineers and the meaning of its various features and resulted in the members of the Branch giving their approval to the Bill as prepared by the Advisory Conference Committee and as introduced in the Legislature.

Papers

With regard to the nature of papers presented at the meetings of this Branch, it has been the aim of the Executive to secure, as far as possible, subjects of a wide and general interest, having a bearing on national and international affairs, rather than obtaining papers upon specific engineering problems. It is felt that in this way the many varied specializations of the profession making up the personnel of the Branch can be better served and in this way a wider interest taken in the meetings.

On October 8th an interesting gathering took place when the Engineering societies of Buffalo and Rochester joined with the Branch in making a trip of inspection over the Queenston-Chippawa Power Development and later in the day joining in a fraternal gathering with an international touch, at dinner in Buffalo.

In January last, a very successful and enjoyable social gathering was held in the form of a dance at the Clifton Hotel, Niagara Falls, Ont.

Membership

The membership has increased during the year from one hundred to two hundred and thirty-three with eight applications for membership. The number of members in each classification is shown as follows:—

	1920	1921
Members	16	19
Associate Members	58	74
Associates	7	2
Juniors	11	20
Students	7	17
Affiliates	1	1
	100	133

The finances of the Branch are in a satisfactory condition with some four hundred dollars in the bank.

Respectfully submitted,

N. R. Gibson,
Chairman.

R. P. Johnson,
Secretary-Treasurer.

Hamilton Branch

The President and Council,

On behalf of the Executive Committee we beg to submit the following report. The Branch year extends from 1st June to 31st May, so that there are two executives in the year.

Meetings

The following meetings were held:—

Jan. 28—"**Legislation,**" Willis Chipman, M.E.I.C. The meeting approved of the proposed act and suggested that every effort be made to have it put through the present session.

Feb. 18—"**Radio Engineering,**" S. M. Kitner, vice-president of the International Radio Telegraph Co. This was a joint meeting with the Toronto Branch of the American Institute of Electrical Engineers, as guests of the Canadian Westinghouse Co. Refreshments were served. There was a record attendance of 175.

Mar. 23—"**Town Planning**", J. W. Tyrrell, M.E.I.C., delegate to the Toronto Convention, gave his report, J. J. Mackay, O.L.S., M.E.I.C., a member of the Town Planning Commission and the Wentworth Road Commission, spoke on Road and Boulevards and what they mean to Hamilton. This was published in the Journal for August P-470.

May 6—"**Annual Meeting**", Reports presented and Nominating Committee elected.

Nov. 1—"**St. Lawrence Route**". The Branch was invited to attend a banquet given by the Chamber of Commerce to the delegates of the Canadian Deep Waterways and Power Association. Henry I. Harriman of Boston, gave an inspiring address.

Nov. 24—"**Annual Banquet at the Royal Connaught Hotel,**" Brig.-Gen. C. H. Mitchell, D.S.O., M.E.I.C., dean of the Faculty of Applied Science of the University of Toronto was guest of honour and gave an address on the Engineering Profession. There was an attendance of 110 members and friends.

Dec. 16—"**Achievements of Sir Sandford Fleming**", Prof. P. Gillespie, M.E.I.C.,. Following this, there was a discussion on Institute affairs.

Membership

	Dec. 31 1920.	Dec. 31 1921.
Members	14	18
Associate Members	42	55
Juniors	11	11
Students	19	29
Affiliates	48	55
Total	134	168

Financial Statement

Revenue

Brought forward	$198.36
Journal Subscriptions	26 00
Rebates	134.43
Branch News	37.09
Sundries	8.21
Affiliate fees	99.00
	$503.09

Expenditures

Miscellaneous	$43.75
Printing and Postage	58.36
Rent Halls	36.00
Annual Dinner	30.50
Stenographer	50.00
Journal Subscriptions	24.00
Balance	260 48
	$503.09

Respectfully submitted,

E. H. Darling,
Chairman.

W. F. McLaren,
Secretary-Treasurer.

Toronto Branch

The President and Council,

On behalf of the Executive Committee I beg to submit the following report of the activities of the Toronto Branch from 1st January, 1921 to 31st December, 1921.

In the first two months of the year we directed attention mainly to the Annual Convention which was held in Toronto early in February and of which such full account was given in *The Journal* that need not be elaborated on here.

During the Spring and Fall meetings were held weekly at which papers and addresses were given — the endeavour being to distribute the subjects through the various branches of Engineering, such as Electrical, Mechanical Chemical, Mining and Civil. This was found very effective and much appreciated. In all 25 regular meetings and 17 executive meetings were held.

In the Spring, visits of inspection were made to the New Union Station, Toronto Harbour Works, Chippawa Power Canal and others, which were very well attended.

Meetings

The following meetings were held:—

- Jan. 6—**General Meeting.**
- Jan. 13—**"Superheaters and Economizers,"** F. A. W. Taylor.
- Jan. 20—**"Reservoirs,"** (illustrated), W. Gore.
- Feb. 1—2—3—**Annual Convention E.I.C.**
- Feb. 10—**"Toronto Gas Works,"** Arthur Hewitt.
- Feb. 17—**"Forms for Concrete,"** T. T. Black.
- Feb. 24—**"New Theory of Concrete Mining and its Use in Large Work,"** R. B. Young and T. V. McCarthy.
- Mar. 3—**"Formation of Ice and its Prevention,"** John Murphy.
- Mar. 10—**"Design of Centrifugal Pumps,"** A. T. Clark and I. M. Jones.
- Mar. 17—**General Meeting.**
- Mar. 24—**"Engineers and Sociology,"** F. M. Crossley.
- Mar. 31—**"Pulp and Paper Works,"** C. Nelson Goin.
- April 7—**"History of Canals in Canada,"** G. T. Clark.
- April 14—**"Engineers and Contractors,"** W. E. Douglas.
- April 21—**General Meeting.**
- April 28—**Annual Meeting.**

Membership

The membership of the Branch is as follows:—

Members	115
Associate Members	251
Associates	6
Juniors	4
Students	103
Total	490

Financial Statement

The following is the financial statement of the year, Jan. 1st, 1921, to Dec. 31st, 1921.

Cash on Hand	$ 157.11
Rebates and Branch News	955.91
Interest	14.15
Affiliates dues	90.00
Rebate from Annual Convention	362.95
Other Items	51.17
	$1,631.29

Expenditures

General expenses, such as rent, postage, stenography, etc.	$649.22
Cash on hand	982.07
	$1,631.29

Respectfully submitted,

F. B. GOEDIKE,

Secretary-Treasurer.

Peterborough Branch

The President and Council,

On behalf of the Executive Committee we beg to submit the Annual Report of the Peterboro Branch for the Calendar year of 1921.

Meetings

Teelve meetings were held during the year a list of which follows:—

- Jan. 13—**"Power Developments on the St. Maurice River",** P. S. Gregory M.E.I.C., of Montreal, electrical engineer for the Shawinigan Water & Power Co.
- Feb. 17—**"Reservoirs",** Wm. Gore, M.E.I.C., consulting engineer, Toronto.
- Feb. 24—**"The Welland Ship Canal," Alex J. Grant,** M.E.I.C., chief engineer of the Welland Ship Canal.
- Mar. 10—**"Oil Refining Practice,"** Clayton D. Dean, A.M.E.I.C., of the Imperial Oil Company.
- Mar. 24—**"Pulp and Paper Mfg.",** P. P. Westbye, M.E.I.C., general manager of the Wm. Hamilton Co. Ltd., Peterboro.
- April 14—**"The Hydro Electric Development at Queenston,"** A. D. C. Blanchard, M.E.I.C., chief field engineer, for the H. E. P. C. on the Chippawa Development
- April 28—**"The Regulation of the Run Off from the Upper Trent Watershed and the Possibilities of Further Conservation,"** A. L. Killaly, A.M.E.I.C., superintendent of the Trent Canal.
- Oct. 13—**"The Complex Nature of a Modern Telephone System,"** Norwood M. Lash, chief engineer of the Bell Telephone Co. of Canada.
- Oct. 27—**"Municipal Sewage Disposal,"** Prof. Peter Gillespie, M.E.I.C., of Toronto University.
- Nov. 10—**"The Construction of 140 miles of Sewers in Vancouver,"** A. G. Dalzell, M.E.I.C., for a number of years city engineer of Vancouver.
- Nov. 17—**"Annual Banquet".**
- Dec. 8—**"Automatic Stations"** G. R. Langley, M.E.I.C., Switchboard engineer for the Canadian General Electric Co., Ltd.

The attendance at the meetings averaged 45, which shows a slight increase over the previous year.

Membership

The membership of the Branch is as follows:—

Members	15
Associate members	24
Juniors	6
Associates	2
Affiliates	24
Total	73

During the last year the Branch had occasion to use a motion picture machine frequently, so it was decided to purchase one for their own use. Now both a motion picture machine and a lantern are available for use when required. This factor has added very much to the interest taken by the members in the regular semi-monthly meetings which are held from October to April inclusive.

We are attaching the financial statement for the Calendar year 1921.

Statement

Revenue

Balance in Bank Jan. 1, 1921	$52.31
Rebates Journal News, etc	134.29
Affiliate Fees	76.00
Annual Dinner	165.00
Balance from Sisson Dinner	5.55
Bank Interest	.73
	$433.88

Expenditures

Rent	$50.00
Lantern Service	10.00
Lunch (Smoker)	10.35
Affiliate Journal Fees	34.25
Expense of Annual Dinner	158.26
Printing	77.66
Speakers' Expenses	8.00
Postage, War tax, etc	6.09
Y.M.C.A. Lantern Purchase on Acct	60.00
Balance in Bank Jan. 1st, 1922	14.47
Chairman's Expenses to Provincial Meeting	4.80
	$433.88

Respectfully submitted,

P. L. ALLISON,
Chairman.

D. L. MCLAREN,
Secretary.

Kingston Branch

The President and Council,

On behalf of the Executive Committee, we beg to submit the following report for the calendar year of 1921.

Meetings were held twice a month on a Tuesday evening at 8 P.M. during the University session. At the first meeting of the Autumn session, the second and fourth Tuesday was chosen as the ones on which professional meetings were to be held. The attendance at all meetings has been of a high average and the interest shown by the student and junior members has given the executive a valuable assistance.

Meetings

Twelve professional meetings were held during the year a list of which is given below:—

Jan. 16—**"Rubber Tire Industry"**. Discussion H. W. Nicoll, educational director of the Goodyear Tire and Rubber Company Limited.

Feb. 15—**"Recent Developments in Concrete,"** Col. H. C. Boyden of the Portland Cement Company.

Feb. 8—**"Economical Design of High Tension Lines,"** W. P. Dobson, M.E.I.C., research engineer of the Ontario Hydro-Electric Power Commission.

Feb. 15—**"Snow Fighting,"** W. H. Winterrowd, A.M.E.I.C., mechanical engineer of the Canadian Pacific Railway.

Mar. 15—**"Fog Signalling,"** Prof. L. V. King, professor of physics, McGill University, Montreal.

April 15—**Annual Dinner at the Frontenac Club, Kingston.** Each member present made a short speech.

Sept. 30—**Business Meeting and Smoker.** Installation of Officers for the session 1921-22.

Oct. 13—**"Prof. Einstein's Theory of Relativity and Gravitation,"** L. T. Rutledge, M.E.I.C., Queen's University.

Oct. 25—**"Cost Keeping as Practised in the Kingston Locomotive Works,"** Wm. Casey, general manager of the company.

Nov. 8—**"Queen's New Heating Plant"**, W. P. Wilgar, M.E.I.C., and L. M. Arkley, M.E.I.C., Queen's University, both of whom were consulting engineers on the design and construction.

Nov. 23—**"Life and Career of Sir Sandford Fleming,"** Prof. Peter Gillespie, M.E.I.C., of the University of Toronto.

Dec. 13—**"The Iron Ores of Canada"** by Prof. Stanley Graham, professor of mining, Queen's University.

Membership

The approximate membership of the Branch is as follows:—

Members	7
Associate Members	21
Junior Members	7
Student Members	16
Associates	1
Affiliates	3
Total	55

As this report covers the activities of two executives the members of both executives are given below:—

1920-21

Chairman,	J. M. Campbell, M.E.I.C.,
Vice-Chairman,	A. Macphail, M.E.I.C.,
Secretary-Treasurer,	W. P. Wilgar, M.E.I.C., Dr. A. L. Clarke, M.E.I.C., L. M. Arkley, M.E.I.C., D. Ellis, M.E.I.C.

1921-22

Chairman,	W. P. Wilgar, M.E.I.C.,
Vice-Chairman,	L. M. Arkley, M.E.I.C.,
Secretary-Treasurer,	L. T. Rutledge, M.E.I.C., J. M. Campbell, M.E.I.C., D. J. Emery, M.E.I.C., A. Macphail, M.E.I.C.

The following is a financial statement for the year 1921.

Revenue

Jan.	1	Cash on Hand	$59.00
Jan.	25	Rebate from fees	63.14
Apl.	9	Sale of dinner tickets	38.00
June	27	Rebate for fees	17.00
		Receipts from Branch News	9.45
Aug.	22	Rebate for fees	30.00
Nov.	18	Rebate for fees	14.50
		Receipts for Branch News	5.00
Dec.	31	Accounts Receivable from Headquarters as per advice	23.11
			$259.20

Expenditures

Jan.	1—Oct. 1	Disbursements	$109.81
Oct.	1—Dec. 31	Disbursements	43.15
			$152.96

Balance on hand Dec. 31st, 1921 $106.24

Respectfully submitted,

W. P. Wilgar,
Chairman.

L. T. Rutledge,
Secretary-Treasurer.

Montreal Branch

The President and Council,

On behalf of the Executive Committee we beg to submit the following report. The activities of the Montreal Branch during the calendar year 1921 have been carried on under two separate Executive Committees, the elective personnel of which were as follows:—

June 1920 to May 1921		June 1921 to December 1921
Arthur Surveyer,	Chairman	J. H. Hunter,
J. H. Hunter,	Vice-Chair.	J. A. Duchastel,
J. L. Busfield,	Sec.-Treas.	J. L. Busfield,
K. B. Thornton,		John T. Farmer,
J. A. Duchastel,		George R. MacLeod,
S. F. Rutherford,		O. O. Lefebvre,
George R. MacLeod,		A. E. Dubuc,
John T. Farmer,		Chas. M. McKergow,
O. O. Lefebvre,		S. F. Rutherford,

In addition to the foregoing, the local members of Council and the immediate Past Chairman of the Branch were ex-officio members of the Committee.

On account of the change of the Branch year, which will in future conform to the calendar year, the Executive Committee under the chairmanship of J. H. Hunter, M.E.I.C., has been in office for only six months, being for the period ending December 31st, 1921.

The Executive Committe has held meetings at frequent intervals throughout the year and in addition to discussing and making arrangements for routine Branch matters, such as the arrangements for meetings, recommendations to Council regarding applicants for admission to *The Institute,* and appointment of various committees, has devoted its attention to a number of matters involving the welfare of the members of the Montreal Branch. Among these matters may be cited the revising of the Branch by-laws; correspondence with the Chairman of the Canadian National Railways Board regarding employment of members of *The Engineering Institute* in engineering positions; co-operation with the Builder's Exchange regarding Quebec building laws; recommendation regarding proposed meeting of Branch Secretaries, and other matters of local interest.

Applications were received during the year for the formation of a Railway and a Marine Section. These two applications were favourably received, making the list of sections of the Montreal Branch as follows:—

	Chairman 1920-21	*Chairman* June to Dec. 1921
Civil Section	O. O. Lefebvre	S. Fortin
Mechanical Section	John T. Farmer	F. A. Combe
Electrical Section	G. K. McDougall	C. J. DesBaillets
Industrial Section	S. F. Rutherford	S. F. Rutherford
Railway Section	. . .	P. B. Motley
Marine Section	. . .	N. E. McClelland

Reception Committees under the chairmanship of George R. MacLeod, M.E.I.C., and Charles M. McKergow, M.E.I.C., were appointed for the two periods. They have carried on their duties at the regular meetings and have given great assistance, not only in enhancing the social atmosphere of the meetings, but also in making valuable suggestions from time to time regarding ways and means of making the meetings attractive.

Membership

There has been a healthy increase in the membership of the Montreal Branch as indicated by the following figures:—

	Dec. 31st, 1920	Dec. 31st, 1921
Honorary Members	3	2
Members	150	181
Associate Members	308	359
Juniors	59	69
Students	184	268
Associates	11	8
Branch Affiliates	12	17
Totals	727	904

A Committee was appointed early in 1921 by the Executive Committee for the purpose of approaching a number of engineers resident in Montreal who, though fully qualified, had not applied for admission to *The Institute.*

Regular Meetings

The Papers and Meetings Committee consisted of J. A. Burnett, A.M.E.I.C., Chairman, and V. I. Smart, M.E.I.C., Vice-Chairman, 1920-21, and John T. Farmer,

M.E.I.C., Chairman, and H. W. Fairlie, A.M.E.I.C., Vice-Chairman for the six months ending December 31st 1921, together with the Chairmen and Vice-Chairmen of the various Branch Sections.

These two Committees have done excellent work in arranging the programme of papers which were presented every Thursday evening, January to April inclusive, and October to December inclusive. These papers covered various phases of engineering work in which the Branch is interested, many being of a highly technical nature, others of more general interest. In addition there were a number of addresses or exhibitions of moving pictures on subjects not directly connected with engineering work. The following table gives a complete list of the regular meetings of the Montreal Branch during the year 1921, with their authors and the attendance:—

conferred upon them by McGill University. This function will long be remembered by those who were fortunate enough to be able to attend.

On October 27th, there took place the inauguration of the Marine Section of the Branch. This event is looked upon as being one of more than passing importance as the formation of the Marine Section will undoubtedly lead to a number of engineers more particularly interested in marine work becoming members of *The Institute.*

On November 17th, the papers on Modern Railway Signalling were presented at the inauguration of the Railway Section of the Branch, which marks the revival of the interest of local railway engineers in *The Institute.*

Another meeting of unusual importance was that on November 24th, when the evening was devoted to Literature instead of Engineering.

Date		*Subject*	*Author*	*Attendance*
Jan.	6	*The Modern Newspaper	Chas. F. Crandall	100
"	13	Fire Prevention; The Engineer's Part	G. H. Greenfield	63
"	20	Bituminous Sands of Alberta	S. C. Ells, A.M.E.I.C.	65
"	27	*The Toronto Hamilton Highway	H. S. Van Scoyoc, M.E.I.C.	74
Feb.	3	*Decay in Structural Timber	H. J. Blair	114
		Preservation of Canadian Timber Products	J. A. Coderre	
"	10	*Aviation (Motion Pictures)		186
"	17	Radio-Telegraphy and Telephony	A. H. Morse	148
"	24	Modern Gas Production	J. J. Humphreys	93
Mar.	3	Sewerage System of Montreal	J. H. Valiquette, A.M.E.I.C.	114
"	3	Sewage Pumps	F. V. Dowd, A.M.E.I.C.	114
"	10	130,000 Volt Surge Protectors	G. C. Read & S. Cunha	96
"	17	Toothed Gears	C. B. Hamilton, M.E.I.C.	95
"	24	*World Shipbuilding	H. R. McClelland, M.E.I.C.	94
"	31	Hydro Plants & Public Utilities at Sherbrooke	C. J. DesBaillets, M.E.I.C.	88
Apr.	7	Street Lighting	C. B. Hastings	73
"	14	Relay Protective Features, Toronto Power Co	P. Ackerman, M.E.I.C.	48
"	21	Some Turbo Machines, Made in Canada	C. E. Newill, M.E.I.C.	76
"	28	Production Engineering	E. T. Spidy, A.M.E.I.C.	75
May	5	*Annual Meeting		
Oct.	6	The Montreal Aqueduct, Historical Sketch	A. E. Doucet, M.E.I.C.	135
"	13	Luncheon Meeting, McGill Re-Union Week		115
"	20	Welding	A. M. Barry & W. H. Ludington	137
"	27	*The Construction of 10,500 Ton Ships at Halifax	N. E. McClelland, M.E.I.C.	247
Nov.	3	Aeroplane Engines	P. E. Biggar, S.E.I.C.	130
"	10	Pulverized Fuel and its Uses	H. G. Barnhurst	130
"	17	*Modern Railway Signalling	C. H. Tillett & C. W. Parker	179
"	24	Some Canadian Writers I Have Met	Col. Geo. Ham	118
Dec.	1	The Montreal Aqueduct—Engineering Features	F. Y. Dorrance, A.M.E.I.C.	127
"	8	The Einstein Theory of Relativity	Professor L. T. Rutledge, M.E.I.C.	240
"	15	Annual Meeting		

*Motion pictures were also shown at these meetings.

Efforts were made during the summer months to arrange for a visit to the Montreal Harbour, but after negotiations had been carried on for some time it was found impossible to conclude the arrangements.

The second half of the period opened on October 6th, with a visit over the Montreal Aqueduct works during the afternoon in which a large number of members of the Branch took part.

Another outstanding event was the luncheon held on October 13th in honour of the six members of *The Institute* who were having the honorary degree of Doctor of Laws

A glance at the attendance figures given in the foregoing table shows that the members of the Branch are taking a keen interest in the meetings. The additional seating accommodation that has been provided in the Hall has already frequently been taxed to its capacity. It is gratifying to know that steps are being taken to improve the ventilation and also to further possibly increase the capacity of the Hall. In the past a number of members have refrained from attending meetings, not only on account of the lack of seating accommodation, but also on account of the lack of proper ventilation.

Publicity

While it has been found impossible to obtain very much publicity for the Branch in the Montreal "Star", the "Gazette" has given the Branch fair recognition, and has usually devoted a fair amount of space to our meetings and discussions. The Star, however, on one occasion, in an article referring to the necessity for the education of Canadian Marine engineers referred to the Montreal Branch of *The Engineering Institute* as having formed a Marine Section and quoting remarks made at the meeting.

Financial Statement

The Financial Statement for the year 1921 follows:—

Revenue

Cash in Bank — January 1st, 1921	$45.08
Rebates — October, November and December	134.25
Rebates, January to March	814.63
Rebates, April to July	274.63
Rebates, August to October	248.75
Branch News	74.19
Affiliate dues	87.50
Sale of Cartoons	24.00
Bus Fares to Aqueduct	31.50
	$1,734.53

Expenditures

Post Card Notices	$347.34
Other printing and stamps	292.24
Secretary's Honorarium	325.00
Clerical Assistance Reporting Meetings	160.00
Telephone and Telegraph	94.50
Stationery	8.00
Moving pictures and lantern slides	253.35
Signs, Chairs, Cartoon, Miscellaneous	164.51
Subscriptions to Journal for Affiliates	33.00
	$1,677.94
Cash in Bank, December 31st, 1921	56.59
	$1,734.53

Outstanding Bills Payable

Printing and post card notices	$144.03

Outstanding Bills Receivable (Estimated)

Rebates for November and December	110.00
Branch News	15.00
Commission on advertising	5.00
Affiliate dues	10.00
	$ 140.00

Respectfully submitted

J. H. HUNTER,
Chairman.

J. L. BUSFIELD,
Secretary-Treasurer.

Quebec Branch

The President and Council,

On behalf of the Executive Committee, we beg to submit the annual report of the Quebec Branch for 1921.

During the past year, 5 general meetings and 8 Executive meetings were held.

Our Legislation Committee did splendid work and, more especially, when a certain bill was introduced to the last session of the Quebec Legislature, it largely contributed in having withdrawn from that bill all that could have affected the rights or prerogatives of the engineers.

We deeply regret the death of J. Emile Girard, A.M.E.I.C., director of surveys for the Department of Lands and Forests for the Province of Quebec. He was highly esteemed by his fellow-engineers and his memory will be piously remembered by the members of this Branch.

At the end of this year, our Branch numbers 14 members, 60 associate-members, 7 juniors, 8 students and 1 associate or a total membership of 90.

Despite the present crisis or economic stringency which is felt all over this country, the position of engineers in our locality may be considered as satisfactory.

Our treasurer's books, on December 27th, 1921, indicate a surplus of $377.82.

Respectfully submitted,

A. R. DECARY,
Chairman.

HECTOR CIMON,
Secretary-Treasurer.

Au Président et au Conseil,

Il nous fait plaisir de vous soumettre, ci-après, le rapport annuel de la Section de Québec pour 1921.

Au cours de l'année dernière, 5 assemblées générales et 8 réunions du conseil furent tenues.

Notre comité de législation a fait bon travail et, plus spécialement, dans le cas d'un bill présenté à la dernière Législature de Québec, il a concouru largement à en faire éliminer tout ce qui pouvait porter atteinte aux droits et prérogatives des ingénieurs.

C' est avec un profond regret que nous soulignons ici, la mort de J. Emile Girard, A.M.E.I.C., directeur des arpentages au Ministère des Terres et Forêts de la province de Québec. Il était hautement estimé de ses confrères et son souvenir sera pieusement conservé par les membres de notre Section.

A la fin de cette année, notre Section compte 14 membres, 60 membres associés, 7 juniors, 8 étudiants et 1 associé, soit un total de 90.

Malgré la crise ou malaise économique que traverse notre pays en ce moment, la situation des ingénieurs de notre région peut être considérée comme satisfaisante

Les livres de notre trésorier accusent, au 27 décembre 1921, un surplus de $377.82.

Respectueusement soumis,

A. R. DECARY,
Président.

HECTOR CIMON,
Secrétaire.

St. John Branch

The President and Council,

On behalf of the Executive Committee of the St. John Branch we beg to submit its fourth annual report, covering the year ending Dec. 31st. 1921.

Meetings

The Executive has met seven times during the year at which meetings general business has been transacted. The Branch held eight regular meetings when interesting papers were read and discussed. In addition, three special dinner meetings were held, an aircraft exhibit was shown and four excursions were made to works of interest in the vicinity of St. John, at two of which the members were the guests of the contractors at luncheon. The members have shown an increased interest in the affairs of the Branch and the meetings are well attended.

The various committees have been actively at work. The Branch has continued its interest in public affairs.

Membership

The membership at the end of the year is as follows:—

Grade	Resident	Non resident	Total
Member	14	3	17
Associate Member	27	5	32
Juniors	10	0	10
Associates	1	0	1
Students	2	0	2
Affiliates	9	1	10

Total end of year 1921	72
" " " " 1920	74
Net loss	2

Statement of receipts and expenditures for the year ending Dec. 31st, 1921.

Financial Statement

Revenue

Balance from 1920	$122.55
Rebate on dues from Headquarters	100.00
Dues and subscriptions from Affiliates	30.00
Branch news	70.84
Special Entertainment receipts	155.00
Total	$478.39

Expenditures

Postage	$30.49
Stationery and Printing	39.86
Telegrams	2.18
Entertainment and Special Meetings	177.43
Hall and Janitor Service	11.00
Advertising	4.05
Journal Subscriptions (Affiliates)	12.00
Sundry Expenses	2.68
Total	$279.69
Balance on Hand	198.70

Respectfully submitted,

FRANK P. VAUGHAN,
Chairman.

HARRY F. BENNETT,
Secretary-Treasurer.

Moncton Branch

The President and Council,

On behalf of the Executive Committee we beg to submit the second annual report of the Moncton Branch.

The Executive Committee held eight meetings during the year 1921. These were twelve meetings of the Branch held at which interesting addresses were given, or papers read.

The membership has increased from thirty-three to fifty-nine during the year, a net gain of twenty-six. We have at present:—

Members	10
Associate Members	32
Juniors	11
Students	4
Affiliates	2
Total	59

We have held two meetings a month during the season, one of which was our popular Supper Meeting, at which the large number present showed great interest in the progress of the Branch and the welfare of *The Institute*.

The Annual Meeting of the Branch was held on May 5th, and after reports were read the following Officers were declared elected for 1921-22:—

Chairman, J. D. McBeath, M.E.I.C.,
Vice-Chairman, S. B. Wass, M.E.I.C.,
Secretary-Treasurer, M. J. Murphy, A.M.E.I.C.

Executive Committee:

A. F. Stewart, M.E.I.C., F. B. Fripp, A.M.E.I.C., F. O. Condon, A.M.E.I.C., Reid McManus, A.M.E.I.C., R. G. Gage, A.M.E.I.C., and H. J. Crudge, A.M.E.C.I.

Financial Statement

The financial statement for the year ending December 31st, 1921, is as follows:—

Revenue

Balance from 1920	$46.60
Rebates on dues and Branch News	160.29
Surplus from Suppers	19.55
Branch Affiliate Fees	6.00
Bank Interest	.52
	$232.96
Rebate due from Headquarters	7.54
Total	$240.50

Expenditures

Postage	8.77
Entertainment of Guests	14.00
Expenses of Meetings	34.11
Printing	30.74
Telegrams and Telephone	1.64
Incidental Expenses	5.40
Total	$94.66
Balance including Rebates due from Headquarters	$145.84

Respectfully submitted,

J. D. McBEATH,
Chairman.

M. J. MURPHY,
Secretary-Treasurer.

Cape Breton Branch

The President and Council,

On behalf of the Executive Committee we beg to submit the Annual Report of the Cape Breton Branch. This Branch was authorized early in 1921, the following therefore, covers the first year of its existence.

Membership

At the date of authorization of the Branch there were seventeen members of all grades resident within the Branch radius, the petition to Council carrying twelve signatures. During the year twenty-nine applications have been received, of which eighteen have been elected. three classified for examination, and eight are pending.

A detailed comparison is as follows:—

	Members	Assoc. Members	Juniors	Students	Total
At Jan. 1921	5	8	3	1	17
Gained by transfer to this district.	–	5	2	1	8
Lost by transfer from this district...	1	2			3
Elected during 1921...	3	13	2		18
Members in good standing Dec. 31, 1921	7	24	7	2	40

Net gain during year..........................23

Meetings

The period from the commencement of the Branch to the annual meeting in May was largely taken up with organization and efforts to promote local interest in *The Institute* among those qualified for membership. Some measure of success in this was obtained, and is indicated by the increase in membership. It is hoped that further efforts by the local members will result in all engineers in our Branch radius realizing the advantages of membership to themselves and to the profession.

A successful meeting was held in May, Fraser S. Keith, the General Secretary making a special trip to Sydney, and his address on Institute affairs and objects was largely responsible for the subsequent activity and increase in membership. Two regular monthly meetings have been held this fall, one devoted to business and one to a professional paper by W. S. Wilson, A.M.E.I.C.

The Executive Committee have held in all, eleven meetings, which were chiefly taken up with matters of organization and the consideration of applications.

Regular meetings have been arranged for the coming months and there are good prospects of a successful season.

The Branch is fortunate in being allied with the Mining Society of Nova Scotia, the headquarters of which are in Sydney. Several members of the Mining Society are members of *The Institute*, and through their interest and courtesy arrangements have been made whereby, for a relatively small rental, the Branch members have the full use of the reading rooms and library of the Mining Society, situated in the Bank of Commerce building, Sydney. This library is probably the most complete reference on mining subjects in the Maritime Provinces, and the rooms are also suitable for our regular monthly meetings. To meet that portion of the rental of these rooms with which we are assessed, the Branch members have agreed to a local quarterly subscription of two dollars.

Financial Statement

Revenue	
Advance from Headquarters	$50.00
Rebates from Headquarters	36.00
Branch News	10.83
Interest on Bank Account	.60
Local Dues	56.00
Total	$ 153.43
Expenditures	
Postage and Telegrams	$ 10.87
Stationery and Printing	16.37
Expenses of Annual Meeting	34.50
Advertising	11.65
Rental of Rooms, Nov. 1 to Feb. 1	45.00
Miscellaneous	4.95
Total	$123.34
Balance in hand.........Bank	15.04
Cash	15.05
	$30.09
Due from Headquarters — Rebates for last quarter.	12.25
Branch News	1.81
	$44.15

Respectfully submitted,

C. M. Odell,
Chairman.

Kenneth G. Cameron,
Secretary-Treasurer.

Halifax Branch

The President and Council,

On behalf of the Executive Committee, we beg to submit the following report. As the Branch year begins in May, this report covers part of two Branch years, with the activities controlled by two separate Executive Committees.

Meetings

During the year, nine meetings were held as folllows:—

Jan. 28—**"The Formation of Ice, and Its Prevention,"** John Murphy, M.E.I.C., of Ottawa, illustrated by moving pictures and lantern slides.

Feb. 23—**"Paints and their Uses,"** J. F. Ryan, Eastern representative of the Sherwin-Williams Paint Company; Number present, 25.

Mar. 24—**"Reinforced Concrete Fishery Piers at St. Pierre-Miquelon,** A. C. Brown, A.M.E.I.C.; Number present, 25.

April 28—"**Engineering Features of Automatic Telephone Equipment,**" A. J. Barnes of the Maritime Telegraph and Telephone Company, illustrated by lantern slides and a miniature exchange.

May 5—"**Reinforced Concrete Pipe for Water Supply,**" W. G. Chase, M.E.I.C., of St. John; Number present, 23.

May 17—**Annual Meeting**, at which the following Officers were elected:—

Chairman	C. E. W. Dodwell, M.E.I.C.
Secretary-Treasurer	O. S. Cox, A.M.E.I.C.
Executive	H. W. L. Doane, A.M.E.I.C.
	F. R. Faulkner, M.E.I.C.
	J. B. Hayes, A.M.E.I.C.
	W. P. Morrison, M.E.I.C.
	K. H. Smith, M.E.I.C.
	L. H. Wheaton, A.M.E.I.C.
(Ex. Officio)	F. A. Bowman, M.E.I.C.

Oct. 20—"**A Trip to Europe with Special Reference to Reconstruction in France after the War,**" Prof. F. H. Sexton; Number present, 46.

Nov. 18—"**General Tramway Engineering,**" I. P. McNab, M.E.I.C.; Number present, 42.

Dec. 9—"**Town Planning,**" H. W. Johnson, asst. city engineer; Number present, 42.

Membership

The membership of the Branch at the end of the year is as follows:—

Members	25
Associate Members	45
Juniors	15
Students	10
Branch Affiliates	5
Total	100

It will be noticed from these figures that while our membership has decreased slightly, the attendance at our meetings has greatly increased, indicating a keener interest in Branch meetings.

Financial Statement

Balance January 1st, 1921		$ 169.65
Revenue		
Headquarters rebates on dues and Branch News	$ 210.77	
Dues from Branch Affiliates	17.00	
Bank Interest	4.62	
Total		$ 232.39
		$ 402.04

Expenditures

Post Cards and Postage	$ 24.79	
Office Supplies	1.10	
Telegrams	4.30	
Printing and Advertising	52.63	
Clerical help	60.00	
Entertainment of Guests	13.75	
Journal Subscription for Branch Affiliates	6.00	
Exchange	.65	
		$ 163.22
Balance Jan. 1st, 1922		$ 238.82

Respectfully submitted,

C. E. W. DODWELL,
Chairman.

O. S. COX,
Secretary-Treasurer.

Ottawa Branch

The President and Council,

On behalf of the Managing Committee of the Ottawa Branch, we beg to submit the following report for the calendar year 1921:—

Several questions of importance affecting the Branch as a whole have arisen during the year, particularly the Bill introduced in the Ontario Legislature. "An Act respecting Professional Engineers" and the Act which was passed by the Dominion Parliament "An Act to amend the Civil Service Act 1918" better known as the Spinney Bill.

The interests of the Branch in connection with the Professional Engineers' Act were looked after first by J. B. Challies, M.E.I.C., and later by A. B. Lambe, A.M.E.I.C., and their untiring efforts to promote the Bill deserve our united thanks. As matters stand at present, this Bill has been introduced, referred to a Parliamentary Committee and is still in the hands of that Committee.

The Spinney Bill contemplated the cancellation of the recent re-classification of Professional Civil Servants and the attitude of *The Institute* towards the Bill is expressed in the following resolution:—

"That *The Engineering Institute of Canada* strongly approved the provisions of the Civil Service Act of Nineteen Eighteen so far as they affected engineers and endorsed the system of making appointments and promotions in the public service by merit and efficiency; that they endorsed without reservation the principles on which the classification of the engineering positions in the federal service was based, as approved in Nineteen Nineteen and appointed a Committee to confer with and assist the Civil Service Commission in their work; that they place themselves on record as opposing and viewing with apprehension any alteration in the Civil Service Act by which appointments, promotions or matters of compensation are placed on any basis but merit, experience and

efficiency and firmly believe that any change of this nature would prejudice the opportunities offered capable men for a career in the service of the Government and would injuriously affect the obtaining of a high standard in the personnel and work of its various departments which can only be secured when merit and merit alone is recognized."

Another question of importance was the "Research Institute Bill" which was introduced last session. As a few members of the Branch considered that this Bill affected them vitally, an interview was arranged with the Research Council and the matter thoroughly discussed. As a result of this, matters were crystallized, the Professional Civil Servants interested met together and took concerted action through their representative body the "Professional Institute of Civil Servants".

Harmonious relations of the closest character have a all times been maintained between the Branch and the "Professional Institute" mentioned above and last year we were honoured in having K. M. Cameron, A.M.E.I.C., a member of the Managing Committee of the Ottawa Branch, as President of the "Professional Institute".

The "Engineers' Ball" under the distinguished patronage of their Excellencies the Governor-General and the Duchess of Devonshire, at the Chateau Laurier, on the 26th January was a success financially and otherwise and it is hoped that this feature will be established as an annual affair.

The "Annual Popular Lecture" was given by Col. Stedman, chief technical officer of the Air Board, and was in every way a credit to the Branch. This feature has proven to be a success and it is the opinion that it is a valuable feature from a publicity standpoint and should be continued.

The three outstanding papers of the year have been presented by members of the Branch viz.: Col. Stedman, Commander Phillips and Mr. Peters and it is hoped that other local members will come forward with papers from time to time.

We are pleased to report that the new Governor-General, His Excellency Lord Byng of Vimy, has accepted Honorary membership in *The Engineering Institute* and has extended his patronage to the second "Annual Ball" which is to be held on the 26th January, 1922.

During the year the Managing Committee held 13 meetings. In addition the Branch had 12 evening meetings and 4 luncheons. The policy has been continued of paying 25% of the cost of the luncheons out of Branch funds.

On the 8th December, J. M. R. Fairbairn, D.Sc., M.E.I.C., President of *The Institute* visited us at a regular luncheon and gave a very interesting address on *The Institute* and its Branches.

Meetings

During the year the following meetings of the Branch were held:—

Jan. 5—**Open meeting for all interested in the proposed Provincial Act respecting Professional Engineers;** at the City Hall.

Jan. 15—**Annual meeting,** University Club.

Jan. 18—**Meeting to discuss proposed Provincial Act respecting Professional Engineers;** at the University Club.

Jan. 26—**Ball,** under the distinguished patronage of their Excellencies the Governor General and the Duchess of Devonshire; at the Chateau Laurier.

Feb. 10—**"Cement and Super-Cement,"** E. Viens and Capt. E. M. Dawson, M.C.E.;Joint meeting with the Society of Chemical Industry, at the Carnegie Library.

Feb. 17—**"Review of Mechanical Ship Propulsion,"** Engineer-Commander T. C. Phillips, M.E.I.C., A.M.I.N.A., M.I.Mech.E., chief engineer Canadian Naval Service; at Victoria Memorial Museum.

Mar. 3—**"Industrial Relations,"** address by Hon. Senator G. D. Robertson, Minister of Labour, at Luncheon at Chateau Laurier.

Mar. 17—**"The Aeroplane and its Development."** The Annual Popular lecture given under the auspices of the Branch by E. W. Stedman, A.R.C.S., A.F.R.A.S., A.M.I.C.E., chief technical officer, the Air Board, Ottawa; evening meeting at the Victoria Memorial Museum.

April 7—**"The Manufacture of Armco Ingot Iron and Specialty Steel Sheets,"** W. T. Jenkins, A.M., A.S.M.E.; evening lecture at Victoria Memorial Museum.

April 14—**"The Proposed Research Institute for Canada,"** address by Hume Cronyn, M.P., Luncheon meeting at Chateau Laurier.

April 21—**"Irrigation in Western Canada,"** lecture by F. H. Peters, M.E.I.C.; in Victoria Memorial Museum.

Oct. 13—**"Forests and the Fire Hazard,"** address by Ellwood Wilson, Manager, Forestry Dept., Laurentide Company, Grand Mere, P. Q.; at luncheon at Chateau Laurier.

Oct. 20—**"Petroleum and its Products,"** evening lecture by C. I. Grierson, B.A.Sc., technical engineer, Imperial Oil Limited, Toronto; at the Victoria Memorial Museum.

Nov. 15—**"The Story of Rock Drilling,"** P. Sherrin, A.M.E.I.C.; evening lecture at Victoria Memorial Museum.

Nov. 24—**"Complex Nature of a Modern Telephone System;"** evening lecture at Victoria Memorial Museum, by N. M. Lash, B.Sc., chief engineer, Bell Telephone Company of Canada, Montreal.

Dec. 8—**The President's visit to the Branch;** J. M. R. Fairbairn, President of **The Engineering Institute of Canada** was the very welcome guest of the Branch at a luncheon at the Chateau Laurier.

Dec. 15—**Evening Entertainment at the Chateau Laurier.**

In the lectures and addresses the Committee has followed the advice given in the report of the Committee on Policy, adopted at the last Annual Meeting, in enhancing the interest of the public towards the profession and in publicity, especially through local mediums. The evening lectures have generally been of a popular, educational nature, and the attendance, averaging 400, would appear to substantiate the course followed. At the monthly luncheons the attendance has averaged 80, and a sustained interest has been shown.

Through the courtesy of the local newspapers, advance notices and comprehensive reports of meetings have been given. During the year the local press has carried an

aggregate of 37 columns, of 22 inches each, of reports and notices of meetings and in addition editorials have appeared.

Continuing the policy of the Branch to invite to its meetings and luncheons, prominent men interested in the subjects to be presented, we have had the honour of meeting Hon. Senator Robertson, Minister of Labour; Tom Moore, President, The Trades and Labour Congress of Canada; Major-General Sir Willoughby Gwatkin; Hon. H. H. Stevens, M.P.; Dr. A. Thompson, M.P.; Hon. F. B. Carvell, Chairman, Board of Railway Commissioners; Dr. J. G. Rutherford, Board of Railway Commissioners; J. B. Hunter, Deputy Minister, Dept. of Public Works; Charles Camsell, Deputy Minister of Mines; E. Brydone-Jack, M.E.I.C., Victoria, B.C.; Willis Chipman, M.E.I.C., Toronto; H. B. R. Craig, M.E.I.C., London; and many others.

Membership

During the year the Committee on Membership held eight meetings and dealt with 55 applications as follows:—

New Members	1
Transfer from lower grade to full membership	4
Associate Members	27
Transfers from lower grade to Associate Members	5
Juniors	6
Transfer from Student	3
Associates	3
Branch Affiliates	1
Referred to Montreal	2
Deferred	2
Refused	1
	55

The following table shows the comparative figures of the Branch membership for the year 1919, 1920 and 1921:—

	1919	*1920*	*1921*
Honorary Members	1	1	1
Members	81	90	89
Associate Members	148	158	167
Associates	2	2	2
Juniors	31	32	35
Students	28	27	24
Branch Affiliates	24	24	19
	315	334	337

Rooms and Library

The question of permanent quarters for the Branch has been discussed at previous Annual meetings and the general feeling has been that the matter should be held in abeyance until some specially favoured opportunity presents itself. Accordingly no active steps have been taken in this direction during the past year except to keep it in view and investigate and report on such possibilities as were brought to the attention of the Committee. Part of the furniture owned by the Branch has been loaned to the Minto Skating Club and it is hoped to dispose of it on favourable terms. The remainder of the furniture is still stored in an unoccupied office.

The Branch Library is now located on the third floor of the Journal Building and has been more extensively used by the members during the past year than previously.

The library is in correspondence with the Library of Congress at Washington, receives all the bulletins issued by it and make use of the cards printed by it for cataloguing purposes. The library is also a member of the Library Association of Ottawa which comprises some fifty separate units. Arrangements are being made with the latter for the exchange of information and for mutual assistance in a number of ways which cannot fail to be a great help to all users of these libraries. One important step has already been taken by compiling a list of all technical and scientific periodicals received by those various libraries which will fill a long-felt want.

This work is in line with the desire to be able to direct inquirers to the proper sources of information where any special request in regard to engineering research is made. It is impossible with the space and money available, for the Branch library to cover even in a very general way the whole field of engineering literature; but it is possible to maintain a reference library which may yield valuable results and this aim is now being realized to a considerable extent.

Colonel Macpherson very kindly presented to the Branch bound volumes of the Proceedings of the Institution of Civil Engineers from the year 1912 to date, thus completing the set which the Branch received some years ago from the late Sir John Kennedy. This series of proceedings with its indexes and abstracts gives a fairly complete history of engineering progress in all its branches throughout the world from the year 1837. Accessions to the library have also been received from Col. Monsarrat, K. M. Cameron, C. D. Norton and the main Institute.

Remuneration

The work of the Committee on Remuneration is to assist in solving the problem of improving the financial status of the engineer and increasing the amount of his remuneration to a level more in keeping with the conditions obtained in other professions and in the business world. A considerable amount of work has been done by many Committees of this character in the classification of positions and the preparation of salary schedules. These schedules will be of great value at the proper time and in the proper place, but it is felt that such things belong to the final rather than the initial stages of the work. The time of the Committee has therefore been spent in examining into and analyzing the conditions and underlying causes which have resulted in the present unsatisfactory state of affairs, with the object of attacking the evil at its root and working up. The result of these deliberations was embodied in a preliminary report which was forwarded to the General Secretary.

Policy

In 1920 the Committee on Policy prepared a very comprehensive report which was submitted to the General Committee of *The Institute.* In this report, taking Section 1 of the By-laws as a starting point, an analysis was given of the most important lines to be followed in promoting its aims.

During the past year the Committee has followed the progress of *The Institute* as affecting the trend of its future development and from time to time has been consulted by the Managing Committee of the Branch in regard to specific matters which have arisen.

Finances

The financial position of the Branch still continues to be highly satisfactory as may be seen by reference to the attached statements of assets and liabilities and receipts and expenditures.

The Branch closes the year with a balance of $614.12 in the bank; $3.66 in cash on hand, and $800.00 in Victory Bonds, a total balance of $1417.78. In 1910 the Branch had a deficit of $175.00, which continued until 1916 when there was a credit balance of about $200.00 which has steadily increased until we now have over $1400.00.

Financial Statement

Revenue

Balance in Royal Bank, Jan. 1st, 1921	$ 419.23
Cash on hand	8.27
Rebates from Main Institute, quarter ending 31-12-20	74.63
" " " " " 31-3-21	296.75
" " " April to July 1921	141.25
" " " Aug. Sept. and Oct. 1921	103.75
" " " Branch News—Jan. to June, 1921	38.06
" " " Branch News—Nov. 1921	5.00
" " " " " —Dec. 1921	5.00
" " " Advertising in Journal	48.00
Proceeds from sale of luncheon tickets	4.50
Branch Affiliates Fees—1921	33.00
Interest on Victory Bonds	44.00
	$1221.44

Expenditures

Chateau Laurier for luncheons	$ 121.90
University Club—3 meetings	57.50
Daly Lunch Room—Luncheon for 12	9.00
Journal Dailies—Advertising	34.40
Citizen Newspapers—Advertising	39.80
Ottawa Electric Railway Co.—Advertising	10.00
Ottawa Printing Co	9.70
Dept. of Interior, Printing	18.00
M. F. Cochrane—Expenses exchanging bonds	10.63
M. F. Cochrane—Subscription to Engineering News Record	7.67
M. F. Cochrane—Engineering Index	7.40
C. P. Edwards—Expenses re lectures	3.55
K. M. Cameron—Expenses re lectures	18.50
Willis Chipman—Expenses re meeting Jan. 5th, 1921	28.00
R. K. Odell—Expenses of smoker	171.89
Insurance	2.00
Petty Cash Expenditures—Postage, etc	53.72
Balance in Bank, Dec. 31st, 1921	614.12
" Cash on hand	3.66
	$1221.44

Audited and found correct
(Sgd.) A. A. Dion.
Ottawa, January 12th, 1922.

Assets

Furniture (Cost $200.00)	$ 80.00
Library:—	
Book Cases (Cost $72.50)	50.00
Bound Magazines Nominal	1.00
Books	25.00
Rebates due from Main Institute on 1921 fees	50.88
Stationery and equipment	20.00
Victory Bonds due December 1st, 1937	500.00
Victory Bonds due November 1st, 1934	300.00
Cash in Bank	614.12
Cash on hand	3.66
	$1644.66

Liabilities

Surplus	$1644.66
	$1644.66

Audited and found correct
(Sgd.) **A. A. Dion.**
Ottawa, January 12th, 1922.

Respectfully submitted,

C. P. Edwards,
Chairman.

F. C. C. Lynch,
Secretary-Treasurer.

JOHN G. SULLIVAN, M.E.I.C.
PRESIDENT
The Engineering Institute of Canada.

John G. Sullivan, M.E.I.C., President of **The Engineering Institute of Canada** for the year nineteen hundred and twenty-two brings to the office the experience of thirty-four years spent in the West, combined with that spirit of optimism and enthusiasm which characterizes the men of the Western provinces.

Mr. Sullivan was born at Bushnells Basin, New York State, on the eleventh day of January, eighteen hundred and sixty-three, and at the age of twenty-five graduated from Cornell University with the degree of C.E. In July of his graduating year, he became associated with railway development in the West, with which he has remained continuously, in many and varied capacities, from that time until the present. Although graduate, he started, as many another good man has done, by working his way up from a rodman, which position he occupied from July eighteen hundred and eighty-eight to April eighteen hundred and eighty-nine on the Great Northern Railway in Montana, Dakota and Minnesota. A year later he was with the Spokane Falls and Northern Railway, occupying positions as rodman, pile inspector, leveller, instrumentman, and finally, as assistant engineer in charge of work. From August eighteen hundred and ninety until February eighteen hundred and ninety-two, he was associated with the Great Northern Railway System in charge of work as assistant engineer on the Seattle and Montana Railway and the following year was in charge of work on the Pacific Extension of the Great Northern Railway. July, eighteen hundred and ninety-three, finds Mr. Sullivan as assistant engineer in charge of work with the Alberta Railway and Coal Company, and the following year as locating engineer with the Butte Anaconda and Pacific Railway Company.

JOHN G. SULLIVAN, M.E.I.C.
President
The Engineering Institute of Canada.

The year eighteen hundred and ninety-five was an important one in Mr. Sullivan's career, as it was then that he came to Canada as locating and division engineer with the Kaslo and Slocan Railway Company, British Columbia. For the next four years he occupied various positions with the Columbia and Western Railway Company, first as reconnaisance engineer and later as principal assistant engineer in charge of all construction and surveys, during which time he was responsible for over one hundred miles of railroad construction, and made surveys for two hundred miles of location for proposed roads. It was on the work of the Pacific Extension of the Great Northern Railway Company that he received his first experience in tunnelling, having been responsible for the construction of two, each fifteen hundred feet long.

In August nineteen hundred, Mr. Sullivan joined the Canadian Pacific Railway as divisional engineer of construction, and with the exception of a year and a half as assistant chief engineer of the Panama Canal, his association with the Canadian Pacific Railway has been continuous up to the present time. In February, nineteen hundred and seven, Mr. Sullivan was made manager of construction of Eastern Lines, and a year and a half later was appointed assistant chief engineer. In nineteen hundred and eleven, his title and responsibility became that of chief engineer of Western Lines, and he occupied the position of chief engineer from nineteen hundred and fifteen to July, nineteen hundred and eighteen, since which time he has been retained with the Company as consulting engineer.

His previous association as an officer of **The Institute**, includes Councillor on two different occasions, and vice-president during the years nineteen hundred and eleven, twelve and thirteen. Mr. Sullivan became a member of **The Institute** in nineteen hundred, having been elected a member of the American Society of Civil Engineers the year before. In nineteen hundred and eighteen he was president of the American Railway Engineering Association. He is a member of the Manitoba and St. Charles Country Clubs, Winnipeg, St. James Club, Montreal, and Cornell University Club, New York.

Mr. Sullivan married Sarah Farrell, daughter of Thomas Farrell, Lodi, N.Y., in eighteen hundred and ninety-five, the family consisting of two sons and two daughters.

Besides enjoying a lucrative consulting engineering practice, President Sullivan has found time for public spirited activities. In nineteen hundred and twenty he was elected alderman for the city of Winnipeg for two years, and at the recent municipal election was re-elected for the term of nineteen hundred and twenty-two and nineteen hundred and twenty-three.

As Chairman of the Manitoba Drainage Commission, which position he has occupied since March nineteen hundred and nineteen, he is an authority on the subject of drainage, and for many years has been known as one of the best authorities in America on the economics of railway location.

A genial personality, true Irish wit, and natural ability of a high order are outstanding characteristics that may be considered as factors in advancing the subject of this sketch to the high position he occupies in the engineering world.

THE
ENGINEERING JOURNAL

THE JOURNAL OF
THE ENGINEERING INSTITUTE
OF CANADA

VOL. V. February 1922 No. 2

Greetings from American Federation of Engineering Societies.

At the commencement of the first session of the Annual General Meeting, a telegram was read by President Fairbairn which was received with great applause, from Dr. M. E. Cooley, President of the American Federation of Engineering Societies. Dr. Cooley is a past-president of the American Society of Mechanical Engineers, and Dean of the Colleges of Engineering and Architecture of the University of Michigan, Ann Arbor, Michigan.

The message reads:—
Fraser S. Keith,
Engineering Institute of Canada,
176 Mansfield Street,
Montreal, Que.

Please convey my greetings to *The Engineering Institute* assembled in Annual Convention, and say to our Canadian brother engineers that the hope was expressed at the Annual Meeting of American Engineering Council in Washington the sixth instant, that *The Engineering Institute* would before long join the American Federation of Engineering Societies. Such membership would go far towards the establishment of a Federation of Engineers of the world which if accomplished could be made a great force in the intelligent discussion and settlement of world problems. It is time that the engineering profession was heard.

M. E. COOLEY, *President*,
American Federation of
Engineering Societies.

The proposal contained in Dr. Cooley's message was left to the Council of *The Institute* for consideration and action.

Policy Committee Meeting.

An important decision was reached at the meeting of Council held at headquarters on January twenty-fifth, in connection with the affairs of *The Institute* when it was resolved that a meeting of the Committee on Policy be held in Montreal, at a date to be chosen by the chairman of the committee, J. B. Challies, M.E.I.C. The committee was authorized to spend not more than twelve hundred dollars as a total expense of the meeting.

As there are so many important suggestions regarding the affairs of *The Institute*, many of them having been under discussion for about two years it was felt by Council that such an important committee could not accomplish the best results by correspondence, and only by a meeting such as the one to be convened would the final report of the committee be possible.

Badge of The Institute

Although a photograph of the official badge of *The Institute* was published previously, it is reproduced here for the benefit of those who have joined *The Institute* more recently. This badge is available either as a lapel button, a pin or a watch fob. The badge for Members is gold, price three dollars and seventy-five cents, for Associate Members silver, price two dollars and twenty-five cents and bronze for Juniors and Students, price one dollar and fifty cents. The owner's name is engraved on the back together with the number of his badge.

These are available through the Secretary's office.

The Thirty-Sixth Annual Meeting

The Annual General Meeting of *The Institute*, was held at headquarters, on Tuesday, January twenty-fourth. President Fairbairn, D.Sc., M.E.I.C., opened the meeting at ten thirty A.M.

Reading of Minutes.

It was moved by C. A. Mullen, M.E.I.C., seconded by K. M. Cameron, M.E.I.C., and carried, that the minutes of the last annual meeting be taken as read. Motion carried.

Appointment of Scrutineers.

It was moved by John Farmer, M.E.I.C., seconded by J. B. Challies, M.E.I.C., that W. S. Lea, M.E.I.C., and G. K. McDougall, M.E.I.C., be appointed scrutineers to report the result of the officers' ballot to the Secretary. Motion carried.

Appointment of Auditors.

It was moved by H. G. Acres, M.E.I.C., seconded by Sir Alex Bertram, M.E.I.C., that Messrs. Riddell, Stead, Graham and Hutchison, be appointed auditors for the ensuing year. Motion carried.

Report of Council.

It was moved by Geo. Mountain, M.E.I.C., seconded by Geo. T. Clark, A.M.E.I.C., that the report of Council, as published on page fifty-one of the February *Journal* be adopted. Motion carried.

Reports of Committees.

Finance Committee: — The report of the Finance Committee being read by the chairman, R. A. Ross, M.E.I.C., published in the February *Journal*, page fifty-five, it was moved by H. R. Safford, M.E.I.C., seconded by C. K. McLeod, A.M.E.I.C., that the report of the Finance Committee be adopted. Motion carried.

Library and House Committee: — It was moved by the chairman, Sir Alex. Bertram, M.E.I.C., seconded by H. R. Safford, M.E.I.C., that the report of the Library and House Committee, as published on page fifty-four of the February *Journal*, be taken as read. Motion carried.

Legislation and By-laws Committee: — It was moved by J. E. Gibault, A.M.E.I.C., seconded by S. Blumenthal, A.M.E.I.C., that the report of the Legislation and By-laws Committee, as published on page fifty-five of the February *Journal*, be adopted. Motion carried.

Papers Committee: — It was moved by John Farmer, M.E.I.C., seconded by W. D. Lawrence, A.M.E.I.C., that the report of the Papers Committee, as published on page fifty-five of the February *Journal*, be adopted. Motion carried.

Publications Committee: — The report of the Publications Committee was read by the Secretary, in the absence of the chairman, H. H. Vaughan, M.E.I.C., as follows:— The Publication Committee beg to submit the following report for the year 1921, covering papers printed in *The Journal* from December 1920 to November 1921, both inclusive. It is recommended that the papers named below be printed in the Transactions; President's Address, R. A. Ross; Toronto Filtration Plant, Jas. Milne; On the Economics of Building Construction, J. Morrow Oxley; Relay Protective Features of the Toronto Transmission and Distribution System, P. Ackerman; A Logical Scheme for Determining the Concrete Making Value of Available Aggregates, G. M. Williams; Self-Corrosion of Cast Iron or Other Metals in Alkaline Soils, W. Nelson Smith and Dr. J. W. Shipley. Signed by Walter J. Francis, Col. R. W. Leonard, R. A. Ross, H. H. Vaughan. On motion by R. M. Hannaford, M.E.I.C., seconded by C. K. McLeod, A.M.E.I.C., the report was adopted.

Canadian Engineering Standards Committee: — It was moved by S. Blumenthal, A.M.E.I.C., seconded by John Murphy, M.E.I.C., that the report of the Canadian Engineering Standards Committee, as published on page fifty-eight of the February *Journal*, be adopted. Motion carried.

Canadian National Committee, International Electro-Technical Commission: — It was moved by J. A. Jamieson, M.E.I.C., seconded by C. K. McLeod, A.M.E.I.C., that the report of the Canadian National Committee of the International Electro-Technical Commission, as printed on page fifty-nine of the February *Journal*, be adopted. Motion carried.

Civil Service Classification Committee: — It was moved by C. K. McLeod, A.M.E.I.C., seconded by H. R. Safford, M.E.I.C., that the report of the Civil Service Classification Committee as published on page fifty-nine of the February *Journal*, be adopted. Motion carried.

Committee on Deterioration of Concrete in Alkali Soils: — It was moved by W. D. Lawrence, A.M.E.I.C., seconded by E. V. Moore, M.E.I.C., that the report of the Committee on Deterioration of Concrete in Alkali Soils, as printed on page fifty-nine of the February *Journal*, be adopted. Motion carried.

Honour Roll and War Trophies Committee: — On motion of General Armstrong, M.E.I.C., seconded by J. H. Hunter, A.M.E.I.C., the report of the Honour Roll and War Trophies Committee as published on page sixty of the February *Journal* was adopted.

International Co-operation Committee: — It was moved by John Murphy, M.E.I.C., seconded by John Farmer, M.E.I.C., that the report of the International Co-operation Committee, as published on page sixty-one of the February *Journal*, be adopted. Motion carried.

Publicity Committee: — On motion of the chairman, Frederick B. Brown, M.E.I.C., seconded by Commander Edwards, the report of the Publicity Committee, as published on page sixty-one of the February *Journal*, whas adopted.

Roads and Pavements Committee: — It was moved by Geo. Mountain, M.E.I.C., seconded by J. A. Duchastel, M.E.I.C., that the report of the Roads and Pavements Committee, as published on page sixty-two of the February *Journal*, be adopted. Motion carried.

Uniform Boiler Specifications Committee: — On motion of S. Blumenthal, A.M.E.I.C., seconded by E. W. Oliver, M.E.I.C., the report of the Uniform Steam Boiler Specifications Committee, as published on page sixty-three of the February *Journal*, was adopted.

Gzowski Medal Committee:—The report of the Gzowski Medal Committee, was read by the secretary, as follows:—Your Committee appointed to judge the papers eligible for this competition, presented to *The Institute* during the year ending June 1920, award this medal to Mr. P. Ackerman, A.M.E.I.C., for his paper on "Relay Protective Features of the Toronto Transmission and Distribution System". Signed by Walter J. Francis, Col. R. W. Leonard, R. A. Ross, H. H. Vaughan. On motion by O. O. Lefebvre, M.E.I.C., seconded by J. B. Challies, the report was adopted. This report also showed the Students' prizes awards as follows:—A. M. Robertson, S.E.I.C., for paper on "Organization of Engine Service during the War", and E. R. Woodward, Jr.E.I.C., for paper on "Lignite Briquetting Plant at Bienfait".

Leonard and Plummer Medal Committees:—It was moved by R. A. Ross, M.E.I.C., seconded by J. A. Jamieson, M.E.I.C., that the reports of the Leonard and Plummer Medal Committees, be received by Council. Motion carried.

The meeting adjourned until two thirty P.M.

In the afternoon session, the Chair was occupied by Vice-President H. G. Acres, M.E.I.C.

Reports of Branches.

Victoria Branch:—On motion of Rex. P. Johnson, A.M.E.I.C., seconded by J. B. Challies, M.E.I.C., the report of the Victoria Branch (February *Journal* page sixty-four) was adopted.

Vancouver Branch:—On motion by S. Blumenthal, A.M.E.I.C., seconded by Sir Alex. Bertram, M.E.I.C., the report of the Vancouver Branch (February *Journal* page sixty-five) was adopted.

Calgary Branch:—On motion by Geo. MacLeod, M.E.I.C., seconded by Col. Magwood, M.E.I.C., the report of the Calgary Branch (February *Journal* page sixty-six) was adopted.

Edmonton Branch:—On motion by J. H. Larmonth, M.E.I.C., seconded by R. L. Dobbin, M.E.I.C., the report of the Edmonton Branch (February *Journal* page sixty-eight) was adopted.

Lethbridge Branch:—On motion by A. C. D. Blanchard, M.E.I.C., seconded by B. E. Barnhill, M.E.I.C., the report of the Lethbridge Branch (February *Journal* page sixty-eight) was adopted.

Saskatchewan Branch:—On motion by J. Clark Keith, A.M.E.I.C., seconded by Capt. Duchastel, M.E.I.C., the report of the Saskatchewan Branch (February *Journal* page sixty-eight) was adopted.

Winnipeg Branch:—On motion by W. Chase Thomson, M.E.I.C., seconded by Major McKergow, M.E.I.C., the report of the Winnipeg Branch (February *Journal* page sixty-nine) was adopted.

Sault Ste. Marie Branch:—On motion by B. E. Barnhill, M.E.I.C., seconded by R. L. Dobbin, M.E.I.C., the report of the Sault Ste. Marie Branch (February *Journal* page seventy-two) was adopted.

Border Cities Branch:—On motion of J. Clark Keith, A.M.E.I.C., seconded by John Farmer, M.E.I.C., the report of the Boder Cities Branch (February *Journal* page seventy-three) was adopted.

London Branch:—On motion by Geo. C. Wright, A.M.E.I.C., seconded by J. W. H. Ford, A.M.E.I.C., the report of the London Branch (February *Journal* page seventy-four) was adopted.

Niagara Peninsula Branch:—On motion by Rex P. Johnson, A.M.E.I.C., seconded by A. C. D. Blanchard, M.E.I.C., the report of the Niagara Peninsula Branch (February *Journal* page seventy-four) was adopted.

Hamilton Branch:—On motion by R. M. Hannaford M.E.I.C., seconded by J. A. Burnett, A.M.E.I.C., the report of the Hamilton Branch (February *Journal* page seventy-five) was adopted.

THIRTY-SIXTH ANNUAL MEETING,

Toronto Branch: — On motion by Geo. T. Clark, A.M.E.I.C., seconded by F. B. Goedike, A.M.E.I.C., the report of the Toronto Branch (February *Journal* page seventy-six) was adopted.

Peterborough Branch: — On motion of R. L. Dobbin, M.E.I.C., seconded by Col. Magwood, M.E.I.C., the report of the Peterborough Branch (February *Journal* page seventy-six) was adopted.

Kingston Branch: — On motion by F. B. Goedike, A.M.E.I.C., seconded by Geo. C. Wright, A.M.E.I.C., the report of the Kingston Branch (February *Journal* page seventy-seven) was adopted.

Montreal Branch: — On motion by P. L. Pratley, M.E.I.C., seconded by Major McKergow, M.E.I.C., the report of the Montreal Branch (February *Journal* page seventy-eight) was adopted.

Quebec Branch: — On motion by J. E. Gibault, A.M.E.I.C., seconded by C. A. Buteau, A.M.E.I.C., the report of the Quebec Branch (February *Journal* page eighty) was adopted.

St. John Branch: — On motion by H. F. Bennett, A.M.E.I.C., seconded by C. C. Kirby, M.E.I.C., the report of the St. John Branch (February *Journal* page eighty-one) was adopted.

Moncton Branch: — On motion by C. C. Kirby, M.E.I.C., seconded by Rex P. Johnson, A.M.E.I.C., the report of the Moncton Branch (February *Journal* page eighty-one) was adopted.

Cape Breton Branch: — On motion by K. G. Cameron, A.M.E.I.C., seconded by K. H. Smith, M.E.I.C., the report of the Cape Breton Branch (February *Journal* page eighty-two) was adopted.

Halifax Branch: — On motion by O. S. Cox, A.M.E.I.C., seconded by K. H. Smith, M.E.I.C., the report of the Halifax Branch (February *Journal* page eighty-two) was adopted.

Ottawa Branch: — On motion by Commander C. P. Edwards, A.M.E.I.C., seconded by O. S. Finnie, M.E.I.C., the report of the Ottawa Branch (February *Journal* page eighty-three) was adopted.

Ontario Provincial Division: — On motion by Col. W. H. Magwood, M.E.I.C., seconded by A. B. Lambe, A.M.E.I.C., the report of the Ontario Provincial Division (February *Journal* page seventy) was adopted.

Report of the Nominating Committee: —The following comprises the Nominating Committee for the year 1922, being the nominees of the various Branches: — Ottawa and Kingston Branches, John Murphy, M.E.I.C.; Border Cities, H. Thorn, M.E.I.C.; Cape Breton, G. D. Macdougall, M.E.I.C.; St. John, C. McN. Steeves, M.E.I.C.; Saskatchewan, C. J. Mackenzie, M.E.I.C.; Vancouver, J. Muirhead, M.E.I.C.; Peterborough, P. L. Allison, M.E.I.C.; Hamilton, J. A. McFarlane, M.E.I.C.; Moncton, J. D. McBeath, M.E.I.C.; Calgary, F. W. Alexander M.E.I.C.; Niagara Peninsula, A. J. Grant, M.E.I.C.; Toronto, Wm. Storrie, M.E.I.C.; Winnipeg, J.G.Legrand, M.E.I.C.; Halifax, F. A. Bowman, M.E.I.C.; Edmonton, C. C. Sutherland, A.M.E.I.C.; Sault Ste. Marie, B. E. Barnhill, M.E.I.C.; Quebec, A. B. Normandin, A.M.E.I.C.; Lethbridge, G. N. Houston, M.E.I.C.; Montreal, O. O. Lefebvre, M.E.I.C., and P. B. Motley, M.E.I.C.; Victoria, K. M. Chadwick, A.M.E.I.C. On motion by Frederick B. Brown, M.E.I.C., seconded by Geo. T. Clark, A.M.E.I.C., the report was adopted.

Amendment to Section 52 of the By-laws.

Moved by Major McKergow, M.E.I.C., seconded by J. B. Challies, M. E.I.C., that this take the usual course, by sending out a ballot, accompanied by a pro and con circular. The chairman nominated A. B. Lambe, A.M.E.I.C., and J. L. Busfield, A.M.E.I.C., to prepare the circular, for and against the proposed amendment. The proposed wording of section fifty-two is:—

MONTREAL, JAN. 24th. 1922.

"Each Branch shall be managed by an Executive Committee or Managing Committee consisting of:

(A) A Branch chairman, a Branch Secretary-treasurer, and not less than three other members, all to be known as elected members and to be ballotted for by all members of the branch entitled to vote at branch elections.

(B) Those members of Council resident within the jurisdiction of the branch, to be known as ex-officio members, and

(C) The immediate past-chairman and the immediate past secretary-treasurer to be known as members emeritus, these latter to be members for only the year immediately following their term of office."

The membership was advised of the proposal as required in the by-laws by an announcement on page six hundred and seventeen of the December *Journal.*

Publicity.

The question of greater publicity for engineers was discussed, and a motion by Mr. Mullen, seconded by Mr. Blanchard that Council appoint a committee to go into the matter of publicity, taking up the matter with local Branches was carried.

Chemist for Concrete Deterioration in Alkali Soils.

It was moved by Mr. Vaughan, seconded by Mr. Hunter that the meeting approve of the action of the Committee on Deterioration of Concrete in Alkali Soils in securing the services of a chemist to carry on their work, on the understanding that it does not commit *The Institute* in case the Committee contracts to spend funds which it has not on hand. An amendment that the matter be referred to Council with power to act was lost, and on standing vote the original motion was carried.

Death of E. D. Lafleur, M.E.I.C.

On motion by K. M. Cameron, M.E.I.C., seconded by Geo. Mountain, M.E.I.C., that the meeting record the heartfelt sympathy of those present for the family of the late E.D. Lafleur, M.E.I.C., and that a message expressing the sympathy of *The Institute* be sent to the family.

Officers Elected.

The report of the scrutineers as read by the Secretary giving the result of the ballot showed that the following officers and members of Council had been elected:—

President.............J. G. Sullivan, M.E.I.C.
Vice-Presidents........C. H. Mitchell, M.E.I.C.,
Arthur Surveyer, M.E.I.C.

Councillors: — District No. 1, J. A. Duchastel, M.E.I.C., Geo. MacLeod, M.E.I.C.; District No. 2, J. E. Gibault, A.M.E.I.C.; District No. 3, A. F. Stewart, M.E.I.C.; District No. 4, Alexander Macphail, M.E.I.C., District No. 5, R. O. Wynne-Roberts, M.E.I.C.; District No. 6, C. H. E. Rounthwaite, A.M.E.I.C.; District No. 7, D. A. Ross, M.E.I.C.; District No. 8, A. R. Greig, M.E.I.C.; District No. 9, R. S. L. Wilson, A.M.E.I.C.; District No. 10, Geo. A. Walkem, M.E.I.C.

Vote of Thanks to Montreal Branch.

It was moved by H. R. Safford, M.E.I.C., seconded by Commander C. P. Edwards, A.M.E.I.C., that this meeting extend a hearty vote of thanks to the Montreal Branch.

The business of the meeting being concluded President J. M. R. Fairbairn, D.Sc., M.E.I.C., delivered his retiring presidential address.

Professional Meeting

In addition to the sessions on Tuesday, January 24th, at which the business of the annual meeting of *The Institute* was transacted there were two enjoyable social functions: a luncheon in the mezzanine dining-room, Windsor Station, at which over one hundred and fifty were present and at which the visiting Branch Secretaries were the guests of honour. The Annual Banquet was held in the Windsor Hotel, the chair was taken by H. G. Acres, M.E.I.C., newly elected Vice-President, and with him at the head table were the following: J. A. Duchastel, M.E.I.C., Geo. Mountain, M.E.I.C., H. R. Safford, M.E.I.C., Sir Alex. Bertram, M.E.I.C., G. Gordon Gale, M.E.I.C., Fraser S. Keith, M.E.I.C., Phelps Johnson, M.E.I.C., C. V. Corless, M.E.I.C., G. H. Duggan, M.E.I.C., Fred. B. Brown, M.E.I.C., J. B. Challies, M.E.I.C., R. A. Ross, M.E.I.C., J. M. R. Fairbairn, M.E.I.C. After the toast to The King, "*The Institute*" was proposed by George A. Mountain, M.E.I.C., and replied to by H. G. Acres, M.E.I.C., who in his speech mentioned his gratification at there being present no less than five past-presidents. The Banquet was followed by a most enjoyable smoking concert. The programme was excellent and reflects great credit on the organizers. *The Institute* was represented on the programme by Professor C. M. McKergow whose number "Thursday Evening at 8.15", a discussion on a technical subject in the manner of three well-known members of Montreal Branch was greeted with loud applause, and Yves Lamongne, Jr.E.I.C., who gave a 'cello selection in his usual finished manner. The other items on the programme also gave much enjoyment, and were enthusiastically received by the members present.

Social Functions

An annual function greatly enjoyed by those fortunate enough to be present, was the dinner given by the retiring President at the University Club on Wednesday evening to the outgoing and incoming Councils. It was a unique occasion in that at the head table there were seven past presidents of *The Institute* and three vice-presidents.

Following the business sessions held on Tuesday January 24th, a one-day Professional Meeting under the auspices of the Montreal Branch was held on Wednesday 25th.

The programme was opened by an excursion to the plant of the Dominion Engineering Works, Lachine, where the new 41,000 H.P. unit now being constructed for the Shawinigan Water and Power Company was inspected. The plant proved most interesting to the visitors, and in addition to the large turbines other machines in course

of erection were inspected. To construct these very large turbines the Dominion Engineering Works has installed the largest vertical boring mill on the continent.

Following the inspection of the Dominion Engineering Works a luncheon was held in the Prince of Wales Salon, Windsor Hotel. The chair was taken by J. A. Duchastel, M.E.I.C., who after proposing the toast to "The King" introduced Alderman Hushion, who, on behalf of the Mayor welcomed the members of *The Institute* for the city. Mr. Duchastel then introduced Prof. H. E. T. Haultain, who addressed the gathering on "The Romance of Engineering".

The subject introduced by an apparently savage attack on the admission of ladies to any of the functions of *The Engineering Institute,* Professor Haultain declared himself one of the chief fighters against this innovation. However, following the gains of the ladies, first at Ottawa, next at Niagara Falls, and Toronto, he had noticed that to date they had never been officially welcomed, and he now took that duty upon himself. He went on to say that there was a very real work which the wives of the members of *The Institute* could perform in developing the "tribal soul". After all, this was the prime purpose of all gatherings of *Institute* members, and where the ladies could help largely was in instilling the *Institute* spirit into the younger men as they came through and graduated from the universities.

Following the luncheon, the afternoon session was opened at headquarters when a most interesting address was given by Julian C. Smith, M.E.I.C., on the design and construction of the new 41,000 turbine unit which had been inspected at the plant of the Dominion Engineering Works that morning. Mr. Smith's paper will be printed in a later number of *The Journal.*

At the evening session a very interesting paper on "The New St. John Cantilever Bridge" was given by Major Draper, describing the numerous unique features of the design and construction. The reading of this paper concluded the Professional Meeting.

Members of The Engineering Institute of Canada photographed at the Dominion Engineering Works Limited at the time of the Annual Convention of the Institute, showing the metal turbine cast steel scroll casing for the forty-one thousand horse power turbine, the largest of its kind ever manufactured, having a weight of two hundred and thirty-eight tons.

Retiring President's Address

J. M. R. Fairbairn D. Sc., M. E. I. C.

Delivered on Jan. 24th, 1922 at Headquarters, Montreal.

When looking back over the past year and endeavouring to look toward the future, with a view to preparing something to say to you to-day, I am immediately led to wonder why custom has decreed that the President of *The Institute* should make his Annual Address at the end of his term of office, instead of at the beginning as is the custom in the Institution of Civil Engineers of Great Britain. If permitted to address *The Institute* at the beginning of the term, one could most pleasantly refer to the mistakes of his predecessors in office, delicately regret the lack of progress in the past, but, with due and becoming modesty, prophesy as to the rosy and successful future that may lie before *The Institute*, knowing full well that he will, at the end of his term hand over to another the results of his own mistakes without having in any way to answer for them. It being decreed otherwise, your President, at the end of his term must seemingly give an account of his own stewardship and prophesy as to the future of *The Institute* under the regime of his successor.

Making Annual Address at Beginning Instead of End of Term.

Before doing this, however, it may be worth while to dwell for a moment seriously on this very point. A newly elected president, at the beginning of his term of office, if making his address then, has a suitable opportunity to express in fitting terms his appreciation of the honour done him by his fellow engineers in electing him to office, an opportune moment to review the history and progress of the organization he is addressing, and a most fitting theme on which to dilate in stating to his fellow members his hopes and ambitions for the future, as well as his policy in trying to bring these into being. His fellow members, on the other hand, are taken into his confidence at the beginning of his term and, knowing his views, can aid and abet him in carrying them out, or caution and advise him as to their probable outcome, as may seem to them best for the welfare of their organization. A change in our procedure on this point is worth thinking over. I commend it to your consideration.

Signs of the Times

Reviewing the past year from the engineer's point of view is a somewhat serious affair. The reaction from the intense activity of the war period, which set in shortly after the signing of the Armistice and has been gathering impetus as it progresses, has now we hope reached its maximum, and, though there must be a constant downward trend in commodity prices for some time yet, it is to be devoutly hoped that with this downward trend there will be a sufficient increase in the demand for manufactured goods to start our industrial life once more on the way to normal production and a need for expansion. Large numbers of our membership, particularly the younger members, have suffered from the depression of the past year, and to many of our older members, who are more permanently established, this has been a matter of considerable concern, every effort being made, wherever possible, to aid those who were in need of it to secure employment. It is impossible to forecast how long industries will remain on their present short time basis. Already there are signs of improvement. Here and there we find groups of labour accepting sensibly the lowering of wages so necessary to get commodity values back to that point where trade will again begin to move briskly. These signs, though comparatively few and far between as yet, are indications of what may be looked forward to, and encourage the hope that it may not be long before we will have again embarked upon a period of industrial progress and expansion, leading to a demand which will create plenty of employment, not only in the field of ordinary and skilled labour, but in the professional engineering field as well.

"Carry On"

In a country such as ours, where vast areas await only the tilling of the soil, and illimitable natural resources only the advent of properly directed labour, with its inseparable partner — capital — to give to man with lavish hand the food and clothing to live and the power and raw materials with which to earn a living, it is impossible that a condition of depression can long exist among a young and energetic people. It is for us to-day to "Carry on", doing each his part to help his fellow over the low spots, and we will soon find ourselves surrounded by that activity and solid progress which is the natural condition of an intelligent and industrious nation.

Progress of Institute

While it is much easier, when considering the general conditions in our own country, to enthuse over the future than over the immediate past, a survey of the work of our own organization, *The Engineering Institute of Canada*, permits one to become enthusiastic over even the results of the past year's progress, as well as to look forward to a bright prospect of greater usefulness in the future. In many ways *The Institute* has made gratifying progress during the past year, the evidence of it being most apparent in the work of the twenty-two Branches which we now have scattered throughout the country. This work and its advantages to the individual member of a Branch apparently appeal to the membership at large, as several new Branches have been formed during the year and still others are now in prospect. The work of the various Branches has already become the most important activity of *The Institute*. It is still gaining in importance and is I believe leading our membership along lines calculated to do the most good in bringing out and developing each individual member of a Branch, making him more valuable to the community in which he dwells, and thereby improving the status of the

engineering profession as a whole. In making themselves felt outside of their own membership, by the holding of open meetings, social functions, etc., the Branches have created an interest among the general public and among engineers, not previously members of *The Institute*, which would appear to be largely responsible for the tremendous increase in membership which the last year has witnessed, in spite of the depressed condition of affairs throughout the country.

Financial Condition

This large addition to our membership is not only evidence of the interest and enthusiasm created by our Branches, but is a most potent factor in building up our revenues and putting the affairs of *The Institute* on a healthy and substantial basis. From the financial point of view, all members of *The Institute* are valuable, but particularly is the new member so in his first year, as he pays, not only his annual dues, but his entrance fee as well. It is a source of considerable gratification to the Council that this year, for the first time in the history of *The Institute*, despite the fact that the proposed increase in fees was turned down by ballot at the last Annual Meeting, they have been able to present to you a financial statement showing such a surplus on this year's operation. The Council has every hope that this will permit of a sum of being set aside this year to pay off the obligations of money *The Institute*, which sum will represent approximately the entire entrance fees of all members taken into *The Institute* this year. It has long been felt that all entrance fees should properly be used for Capital Account, and that Maintenance and Operating Expenses should be held down to a point where they can be met by the Current Annual Dues of the membership and Other Regular Sources of Annual Revenue. It is to be hoped that *The Institute's* affairs may so flourish that the precedent set this year can be followed in the future.

Growth of Institute

The year just passed shows a very marked contrast between the trend of business affairs throughout the country and the progress of *The Engineering Institute.* While business has been slowing down, the growth of *The Institute* has been speeding up.

Extending Charts

In January, 1917, Dr. G. Herrick Duggan, when retiring from office as your President, presented a series of charts showing graphically the increase in membership since the incorporation of *The Institute* in 1887. It seems appropriate at the present time to extend these charts to the end of 1921 and present them once more for your information.

First Chart

As shown on the first chart, there were, at the end of 1916, some 700 members, some 1400 associate members,

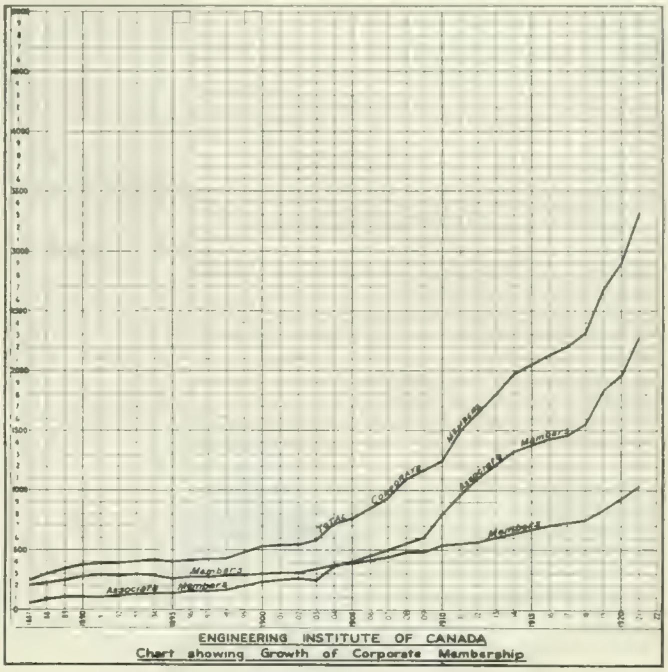


Figure 1.

or a total of some 2100 corporate members. This chart indicates the greatly accelerated increase in membership which has taken place since the Armistice, which has now carried the number of members to slightly over 1000, the number of associate members to very nearly 2300, and the total corporate members to somewhat over 3300. The fact that the increase in corporate membership was greater during 1921 than during any previous year would seem to indicate that it has by no means yet reached a peak, and I believe that you are justified in expecting your corporate membership to continue to increase at a very rapid rate for some time yet to come.

Second Chart

As shown on the second chart, there were at the end of 1916, some 900 non-corporate members, some 2100 corporate members, and a total membership in *The Institute* of just under 3100. Although during the war period your corporate membership continued to increase at a reasonable rate, the non-corporate membership varied materially from year to year, in such a manner as to make a relatively slight increase in your total membership between the end of 1912 and the end of 1918. After the Armistice, however, the non-corporate membership began to increase relatively as rapidly as the corporate membership, so that between the end of 1916 and the end of 1921 the total membership of *The Institute* increased from slightly less than 3100 to practically 4900, or a total increase for the five years of approximately 1800 members. I believe this chart also warrants the belief that *The Institute*, insofar as membership is concerned, is but now starting to rise on a wave of prosperity.

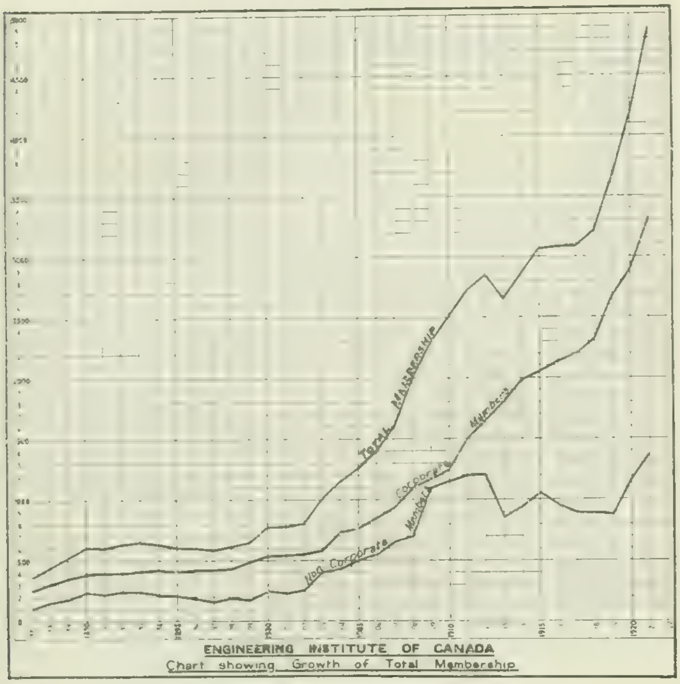


Figure 2.

Third Chart

The third chart, which shows the geographical distribution of your membership with the exception of students, is I believe even more gratifying. Although there has been a slight decrease in your total membership resident in the United States and other foreign countries, the Dominion-wide interest in *The Institute* which has been aroused is very clearly indicated by the fact that there has been an increase in membership in each one of the provinces since 1916. Ontario leads by a wide margin in this increase, but the trend for all of the other provinces is very markedly upward.

Fourth Chart

The fourth chart shows this same information in percentage rather than in actual numbers, and, while there is a decreased percentage of membership in the older and more settled provinces, there is an increase in the newer and less settled provinces, which is most gratifying. This indicates that the membership is becoming more equally distributed and that the engineering profession throughout Canada is all the time becoming better represented in the major engineering organization of the Dominion.

Fifth Chart

The fifth chart brings out very clearly the present geographical distribution of your membership. Well over 50% is resident in the Provinces of Ontario and Quebec, which, on account of the greater population of these provinces, is to be expected. It is my hope, however, that as time progresses and the population of the Dominion becomes more equally distributed, the percentage columns of the other provinces will tend to rise and in so rising automatically reduce the height of the columns representing the older provinces, so that ultimately your membership will approach the ideal of equal numbers in each of the eight provinces.

Summary of Charts

A study of the five charts just described cannot but enthuse one as to the future. It may be felt that the remarkable increase in membership shown during the last three years is perhaps accounted for by the return to civilian life of so many young men just starting out in their life's career, but it is my belief that such membership increase as may be due to this cause is more than offset by the hardship felt, during the declining market for engineers of the past three years, by those from whom we ordinarily draw our additions to membership. In any case the increase is a fact, and the most natural explanation for it is the favourable publicity which the excellent work of our Branches has been given among the engineering profession. May we not, therefore, feel that as the Branches grow and broaden the scope of their activities, a continuance of the rapid increase in our membership may be expected.

Organization

We have already 22 Branches, and, as these increase in number and in strength, it is evident that the parent body, or headquarters organization, must also increase or be modified in such manner as may seem necessary, in order to properly and efficiently co-ordinate the work of these Branches, and function as a tie to hold them together

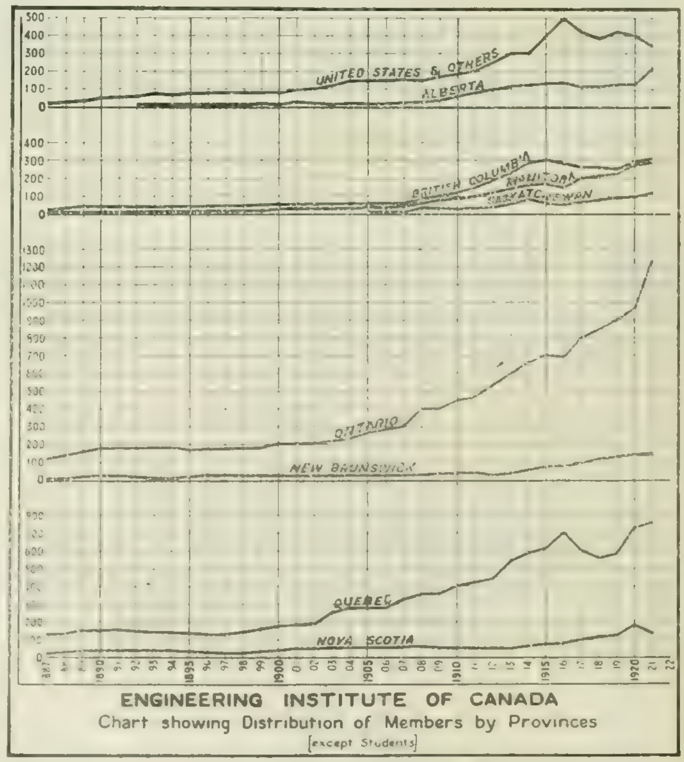


Figure 3.

and a clearing house through which there may be the freest interchange of ideas, proceedings and general results of Branch work. The ultimate success of *The Institute* lies, primarily, in keeping the Branches in close touch with one another and thus enabling *each little group of us* to work with *every other group of us* toward our ultimate goal — that *all of us* may be of the greatest possible service to thepublic at large and, therefore, to the engineering profession as a whole.

Members in Outlying Districts

One of the problems which will have to be met in the near future is how to interest those of our members in outlying districts whose location does not permit their participation in Branch affairs. They are at a distinct disadvantage and some means will have to be found whereby they can be brought into closer touch with the work of their fellow engineers. Just how this can be done is not clear, but, already, indications of unrest on the part of some such members are becoming evident, and a most careful consideration should be given to this subject in order that their interests may be served and their co-operation maintained.

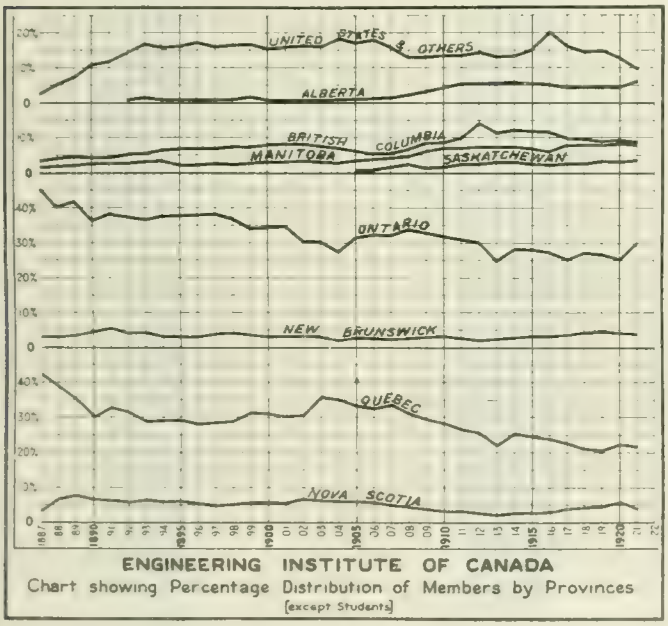


Figure 4.

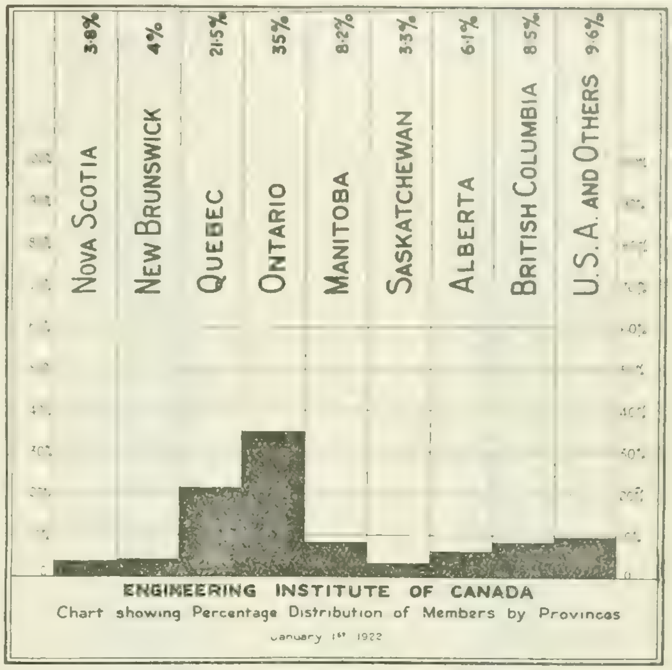


Figure 5.

Questions to be Kept in Mind

We have now reached a stage in the condition of the profession where it seems wise to keep before us several questions upon which *The Institute* can be of the greatest value. Such matters as *professional ethics; publicity of a suitable and dignified character; the enrollment of all engineering students at our universities in our membership; the possibility of adding to the classes of membership, or of broadening some of the existing classes, to take in more of those in the engineering field, or associated with it, who are not now eligible under the existing classes,* and a number of other questions more or less related to these, some of which are now under consideration by the various committees, should be kept in mind and, where possible, definite policies in regard to them adopted. With the Branches heartily co-operating in the carrying out of such policies, and the stimulation of interest in these matters which their co-operation would immediately bring about, there lies before us an opportunity for growth, expansion and improvement as a body which should make *The Engineering Institute of Canada* a most potent factor in determining the position which our membership will hold in their respective communities and the respect which the profession as a whole will command in the public mind.

Thirty-sixth Annual and Professional Meeting

Registration

	Name	Address
1	Charles M. McKergow	Westmount.
2	A. L. Patterson	Montreal.
3	George T. Clark	Toronto.
4	Fraser S. Keith	Montreal.
5	F. B. Goedike	Toronto.
6	Wm. McNab	Montreal.
7	G. E. Bell	Montreal.
8	A. Boyer	Montreal.
9	G. K. McDougall	Montreal.
10	T. A. Chubb	Montreal.
11	J. L. Busfield	Montreal.
12	John T. Farmer	Montreal.
13	J. A. Burnett	Montreal.
14	Heber W. Dawson	Montreal.
15	C. H. T. Simm	Montreal.
16	Royal Le Sage	Montreal.
17	A. M. MacKenzie	Montreal.
18	C. A. Allan	Strathmore.
19	G. R. MacLeod	Montreal.
20	J. Clark Keith	Windsor.
21	Henry Holgate	Montreal.
22	A. W. Swan	Montreal.
23	James S. Costigan	Montreal.
24	J. H. Hunter	Montreal.
25	Geo. F. Alberga	Montreal.
26	J. A. Lalonde	Montreal.
27	J. H. Dupuis	Montreal.
28	D. W. Ross	Montreal.
29	W. S. Lea	Montreal.
30	J. A. Jamieson	Montreal.
31	R. A. Ross	Montreal.
32	H. L. Trotter	St. Johns.
33	W. B. Crombie	Montreal.
34	W. C. Adams	Westmount.
35	Gordon McL. Pitts	Montreal.
36	A. C. D. Blanchard	Niagara Falls.
37	Wilson J. Muir	Montreal.
38	Ernest V. Moore	Montreal.
39	Kenneth G. Cameron	Sydney.
40	E. A. Ryan	Montreal.
41	Frederick W. Cowie	Montreal.
42	Alex. Bertram	Montreal.
43	R. Armour	Montreal.
44	H. R. Safford	Chicago, Ill.
45	G. E. Templeman	Montreal.
46	F. A. Combe	Montreal.
47	J. LeRoy Underhill	Sydney Mines.
48	C. K. McLeod	Montreal.
49	G. C. Wright	London.
50	F. O. Orr	Alfred Station.
51	G C. Dunn	Toronto.
52	R. M. Charlton	Montreal.
53	Harry F. Bennett	St. John.
54	H. K. Wicksteed	Toronto.
55	A. L. Farnsworth	Montreal.
56	J. E. Gibault	Quebec.
57	E. E. Holmes	Montreal.
58	Edw. T. Mug	Montreal.
59	C. D. Woolward	Montreal.
60	R. W. Farmer	Montreal.
61	W. Chase Thomson	Montreal.
62	L. R. Thomson	Montreal.
63	E. W. Oliver	Toronto.
64	G. Marryat	Montreal.
65	L. W. Deslauriers	Montreal.
66	W. J. McAllister	Montreal.
67	H. M. MacKay	Westmount.
68	Brig.-Gen. C. J. Armstrong	Montreal.
69	R. Bickerdike, Jr.	Montreal.
70	J. F. Grenon	Chicoutimi.
71	R. E. Stavert	Montreal.
72	Rex P. Johnson	Niagara Falls.
73	H. G. Acres	Niagara Falls.
74	A. L. Harkness	Montreal.
75	I. F. Roche	Bienfait, Sask.
76	D. E. Perriton	Montreal.
77	C. W. Stokes	Montreal.
78	J. B. Wain	Montreal.
79	C. R. McCort	Westmount.
80	G. H. Duggan	Montreal.
81	Fred. A. McKay	Westmount.
82	C. G. Porter	Montreal.
83	H. W. B. Swabey	Montreal.
84	L. N. Jenssen	Montreal.
85	J. M. R. Fairbairn	Montreal.
86	P. E. Demers	Montreal.
87	W. F. Tye	Montreal.
88	H. Labrecque	Montreal.
89	S. E. Oliver	Montreal.
90	D. W. McKeen	Montreal.
91	J. J. O'Sullivan	Montreal.
92	L. H. Marrotte	Montreal.
93	C. C. Kirby	St. John.
94	N. L. Engel	Montreal.
95	H. M. Lyster	Montreal.
96	Geo. E. Newill	Montreal.
97	A. Duperron	Montreal.
98	E. A. Stone	Montreal.
99	Eugene Vinet	Montreal.
100	R. H. Ross	Montreal.
101	J. G. Notman	Montreal.
102	J. Gordon Robertson	Montreal.
103	W. J. Evans	Montreal.
104	E. P. Taylor	Montreal.
105	Robert Ford	Montreal.
106	J. D. Fry	Montreal.
107	H. A. Wilson	Montreal.
108	S. H. Wilson	Montreal.
109	P. G. Gauthier	Montreal.
110	R. A. McGregor	Montreal.
111	S. S. Colle	Montreal.
112	Frank M. Buchanan	Montreal.
113	H. S. VanScoyoc	Montreal.
114	B. J. Forrest	Montreal.
115	G. H. Fisk	Montreal.
116	J. B. Challies	Ottawa.
117	L. G. Papineau	Outremont.

	Name	Address
118	Kenneth H. Smith	Halifax.
119	George Kydd	Orillia.
120	Chas. A. Mullen	Montreal.
121	Arthur Vincent	Montreal.
122	K. M. Cameron	Ottawa.
123	James Ruddick	Beaupre.
124	J. M. Robertson	Montreal.
125	J. S. Cote	Edmonton.
126	Geo. F. Richan	Ottawa.
127	L. A. Desy	Montreal.
128	A. B. Lambe	Ottawa.
129	J. R. Stewart	Renfrew.
130	A. E. Jennings	Toronto.
131	C. P. Edwards	Ottawa.
132	W. P. Roper	Montreal.
133	M. F. Cochrane	Ottawa.
134	M. W. Maxwell	Anyox.
135	W. D. Lawrence	Montreal.
136	H. C. Kennedy	Montreal.
137	Geo. Mountain	Ottawa.
138	P. Johnson	Montreal.
139	John Murphy	Ottawa.
140	I. J. Tait	Montreal.
141	William Hay	Montreal.
142	A. S. Wall	Montreal.
143	M. J. Murphy	Moncton.
144	P. E. Biggar	Montreal.
145	S. Blumenthal	Montreal.
146	H. S. Deubelbeiss	Outremont.
147	R. M. Hannaford	Montreal.
148	J. Labell	Montreal.
149	John W. Seens	Montreal.
150	R. Sprenger	Montreal.
151	R. L. Dobbin	Peterborough.
152	B. E. Barnhill	Sault Ste. Marie.
153	R. A. Strong	Bienfait, Sask.
154	G. F. Cairnie	Westmount.
155	D. G. Anglin	Montreal.
156	Frederick B. Brown	Montreal.
157	K. M. Ramsey	Montreal.
158	Albert J. Kelley	Montreal.
159	T. A. G. Bishop	Montreal.
160	Edw. W. Francis	Montreal.
161	T. L. Crossley	Toronto.
162	Robert M. Robertson	Montreal.
163	J. E. Desy	Montreal.
164	R. H. Hunter	Montreal.
165	A. A. Putman	Montreal.
166	W. S. Gould	Montreal.
167	L. O'Sullivan	Montreal.
168	E. M. Bene	Montreal.
169	Alfred LaRocque	Montreal.
170	O. Lefebvre	Montreal.
171	P. W. St. George	Montreal.
172	A. B. Normandin	Quebec.
173	Douglas Bremner	Montreal.
174	J. A. Duchastel	Montreal.
175	H. A. Wilson	Montreal.
176	Wm. Kennedy, Jr.	Montreal.
177	W. H. Magwood	Cornwall.
178	C. M. Morssen	Montreal.
179	W. A. Messenger	Montreal.
180	H. T. Kirkpatrick	Montreal.
181	W. R. McClelland	Montreal.
182	N. E. Brooks	Sherbrooke.
183	Peter Emslie	Montreal.

	Name	Address
184	A. Ghysens	Montreal.
185	L. H. Laffoley	Montreal.
186	B. E. Norrish	Montreal.
187	E. S. Holloway	Matane, Que.
188	R. S. Eadie	Montreal.
189	S. Bonneville	Montreal.
190	H. L. Banfill	Montreal.
191	C. L. Cote	Montreal.
192	H. M. Black	Montreal.
193	G. S. Clark	Montreal.
194	G. R. Heckle	Montreal.
195	E. R. Pease	Montreal.
196	R. E. Jameson	Montreal.
197	Henry M. Lamb	Montreal.
198	R. M. Walker	Montreal.
199	H. E. Mott	Montreal.
200	A. M. Robertson	Montreal.
201	D. W. McLachlan	Ottawa.
202	F. C. C. Lynch	Ottawa.
203	R. DeL. French	Montreal.
204	E. Viens	Ottawa.
205	Edward C. Little	Montreal.
206	E. Brown	Montreal.
207	B. W. Seton	Montreal.
208	J. L. Rannie	Ottawa.
209	O. S. Finnie	Ottawa.
210	Noel Ogilvie	Ottawa.
211	Huet Massue	Montreal.
212	Aimé Cousineau	Montreal.
213	G. H. Carsen, Jr.	Montreal.
214	W. C. Way	Ottawa.
215	C. M. Bennett	Montreal.
216	G. H. Desbarats	Montreal.
217	J. C. Kemp	Montreal.
218	G. Blanchard Dodge	Ottawa.
219	E. V. Brown	Montreal.
220	Walter Matheson	Montreal.
221	John S. Brisbane	Westmount.
222	G. C. Perkins	Montreal.
223	J. I. Monette	Montreal.
224	John Bonsall Porter	Montreal.
225	C. P. Creighton	Montreal.
226	H. B. Stuart	Montreal.
227	A. S. Poe	Montreal.
228	A. H. Milne	Montreal.
229	W. B. MacKenzie, Jr.	Montreal.
230	W. V. Delaney	Montreal.
231	E. V. Gage	Montreal.
232	John E. Armstrong	Montreal
233	L. H. Armstrong	Montreal,
234	John E. Paddon	Montreal.
235	Bertwell C. Root	Westmount.
236	Fred Newell	Montreal.
237	E. A. Beck	Montreal.
238	A. J. MacDonald	Montreal.
239	J. E. Openshaw	Montreal.
240	S. F. Rutherford	Montreal.
241	A. C. Tagge	Montreal.
242	A. S. Runciman	Ville La Salle.
243	O. S. Cox	Halifax.
244	Harold Rolph	Montreal.
245	G. C. Freeman	Montreal
246	F. I. C. Goodman	Montreal.
247	T. W. Lesage	Montreal.
248	J. H. Larmonth	Montreal.
249	Chas. Stephen	Montreal.

	Name	Address
250	T. H. G. Clunn	Ottawa.
251	D. Hillman	Montreal.
252	J. W. Harkem	Melbourne.
253	J. F. Harkem	Melbourne.
254	H. H. Vaughan	Montreal.
255	K. R. McLennan	Montreal.
256	A. Crumpton	Montreal.
257	R. E. Crawford	Montreal.
258	H. Steenbuch	Montreal.
259	E. C. Girouard	Montreal.
260	G. J. Morrissette	Montreal.
261	K. B. Thornton	Montreal.
262	John J. York	Montreal.
263	G. H. Gagnet	Edmonton.
264	P. L. Pratley	Montreal.
265	A. R. Bingham	St. Timothee.
266	C. N. Monsarrat	Montreal.
267	G. L. Guillet	Rochester, N.Y.
268	C. J. Desbaillets	Montreal.
269	M. F. Williams	Montreal.
270	J. S. Goddard	Montreal.
271	Donald G. Kyle	Montreal.
272	Walter T. Moodie	Port Arthur, Ont.
273	C. A. Boulton	Montreal.
274	F. A. Chisholm	Drummondville.
275	G. Reed	Montreal.
276	Andrew S. Rutherford	Montreal.
277	Major J. Shepherd Lee	Halifax.
278	A. D. Swan	Montreal.
279	E. R. Woodward	Montreal.
280	F. H. McKechnie	Montreal.
281	J. R. Bradfield	Montreal.
282	Bruce B. Shier	Montreal.
283	W. J. S. Dormer	Montreal.
284	E. T. Harbert	Montreal.
285	F. E. Amlie	Montreal.
286	Henry B. Sims	Montreal.
287	J. H. Harries	Montreal.
288	Y. Lamontagne	Montreal.
289	Donald Ross-Ross	Montreal.
290	R. W. Mitchell	Montreal.
291	G. C. Monture	Kingston.
292	L. T. Rutledge	Kinsgton.
293	R. W. Findlay	Lachine Locks.
294	G. G. Gale	Ottawa.
295	A. V. Gale	Ottawa.
296	Cancelled	
297	G. B. Elliott	Montreal.
298	G. D. Coughlan	Montreal.
299	S. E. Junkins	Winnipeg.
300	F. L. Darrell	Kenogami.
301	T. E. A. Hall	Montreal.
302	S. J. H. Waller	Montreal.
303	James Ferguson	Montreal.
304	A. C. Loudon	Montreal.
305	E. J. Turley	Montreal.
306	S. F. Gualtieri	Montreal.
307	D. Leclerc	Montreal.
308	F. N. Harling	Montreal.
309	J. T. Quinlan	Montreal.
310	W. J. Kingsmill	Montreal.
311	L. G. Cox	Montreal.
312	R. B. Young	Toronto.
313	Arthur Surveyer	Montreal.
314	J. C. Smith	Montreal.
315	G. P. Hawley	Cedars.
316	J. S. Le Page	Montreal.
317	L. C. Jacobs	Montreal.
318	A. W. McMaster	Sydney.
319	R. E. MacAfee	Montreal.
320	S. J. Fisher	Ottawa.
321	G. W. Thompson	Montreal.
322	D. L. McLaren	Peterborough.
323	P. E. Jarman	Montreal.
324	C. B. Bate	Hawkesbury.
325	W. F. McLaren	Hamilton.
326	A. Laurie	Montreal.
327	H. G. Welsford	Winnipeg.
328	V. E. Friedman	Montreal.
329	A. Peden	Montreal.
330	C. E. Herd	Montreal.
331	J. Robertson	Montreal.
332	John Chalmers	Montreal.
333	C. F. Draper	Montreal.
334	C. S. Kane	Montreal.
335	G. H. Osborne	Montreal.
336	W. C. Adams	Montreal.
337	C. R. Young	Toronto.
338	F. T. Kaelin	Montreal.
339	De Gaspé Beaubien	Montreal.
340	Brig.-Gen. C. H. Mitchell	Toronto.
341	H. C. Nourse	Sherbrooke.
342	C. V. Christie	Montreal.
343	L. Hovey	Montreal.
344	W. L. Dawson	Montreal.
345	B. C. Salamis	Montreal.
346	J. H. D. Ross	Montreal.
347	C. M. Wylde	Montreal.
348	E. S. M. Lovelace	Montreal.
349	G. E. Elkington	Montreal.
350	E. H. Morley	Montreal.
351	P. B. Motley	Montreal.
352	Peter Gillespie	Toronto.
353	Wm. A. Gilmour	Montreal.
354	Sadi Amiot	Chicoutimi.
355	P. S. Gregory	Montreal.
356	J. A. McCrory	Montreal.
357	R. H. Balfour	Montreal.
358	A. R. Henry	Montreal.
359	W. A. B. Hicks	Montreal.
360	C. B. Jandrew	Montreal.
361	A. V. Armstrong	Montreal.
362	J. H. Oliver	Montreal.
363	J. D. Peart	Lachine.
364	A. H. Chisholm	Montreal.
365	W. P. Seath	Montreal.
366	E. T. Spidy	Montreal.
367	C. E. Herd	Montreal.
368	L. S. McLennan	Montreal.
369	H. J. Goldberg	Montreal.
370	D. G. MacKenzie	Montreal.
371	J. C. Elder	Montreal.
372	J. L. T. Martin	Montreal.
373	R. L. Latham	Hamilton.
374	H. E. T. Haultain	Toronto.
375	Edward Normand	Montreal.
376	H. W. D. Armstrong	Toronto.
377	James J. Taylor	St. John.

CORRESPONDENCE

Canadian Electrical Association Meetings

Editor, *Journal:*—

Dear Sir,

Referring to your letter of the 6th inst., re dates of meetings for the Montreal Section of the C.E.A., I beg to advise you that the Programme Committee at their meeting of recent date, have decided to hold meetings on the following dates:—

Jan. 16—"Paper on Illumination", by Geo. K. McDougall.

Feb. 6—"Address", by M. H. Aylesworth, executive manager, National Electric Light Assoc., New York.

" 27—"Paper on Electrical Protective Devices", by a speaker supplied by J. W. Pilcher.

Mar. 20—"Paper on Meters and Metering", by a speaker supplied by Chas. F. Medbury

Apr. 10—"Paper on Merchandising", by Geo. Atchison.

" 24—"Social Evening for the closing of the Season".

It was decided to have a meeting every third week, instead of monthly, on account of the season being so short. It might be that some of the subjects referred to in this programme may have to be altered but the dates will very likely remain the same.

I should like to mention that any members of *The Engineering Institute* who should be interested in any of these subjects are welcome at our meetings. Our purpose is to have papers and talks which will be useful to our members without interfering with any of the organized bodies, at present. It is quite possible that some of the members of other associations might be interested in our papers and a welcome invitation is extended to them.

Thanking you for your good wishes for the new year, which I duly reciprocate, I am,

Yours very truly,

EUGENE VINET, A.M.E.I.C.,
Secretary-Treasurer.

Symposium on Water Power

A symposium on Water Power Development is being planned at the University of Toronto under the direction of Professor R. W. Angus, M.E.I.C., head of the Department of Mechanical Engineering, and professor in charge of the hydraulic work at the University. This will take place during the last week in February and the first week in March of this year and each phase of hydraulic power development will be dealt with by a specialist.

A number of eminent hydraulic engineers in Canada and the United States are being invited to contribute to the conference. The discussions will be of distinctly technical character and of interest particularly to practising engineers.

The details are now being arranged and a copy of the programme will be sent when ready to anyone applying to Professor Angus, University of Toronto.

Safety Census

All branches of the engineering profession will watch with close interest the results of the safety census now being taken by the National Safety Council.

The census which the National Safety Council is taking will include all persons engaged in safety and industrial health activities in all industries in all parts of the country, and persons doing public safety work as well. This is the first time any attempt has everbeen made to list all the persons engaged in these activities professionally.

The census will include not only members and employees of members of the National Safety Council, but all persons engaged in industrial safety and health work and public safety work whether connected with the Council in any way or not. Many consulting engineers and other engineers are included in the membership of the Council. The Council works in close co-operation with the leading engineering societies, government bureaus, such as the Bureau of Standards, Bureau of Mines, and other such agencies. Engineering plays a big part in the safety work being carried on under the leadership of the National Safety Council.

Every member of *The Institute* who is professionally engaged in industrial or public accident prevention or industrial health work — whether he is devoting all or only part of his time to accident prevention — is urged to assist in the taking of this census by sending to the National Safety Council, 168 North Michigan Avenue, Chicago, his name and the other date requested in the Council's census form which is reproduced below.

Following is the form which all safety workers are requested to fill in and send to the National Safety Council, 168 N. Michigan Ave., Chicago.

Name..
Company or organization....................................
City.................... State................................
Nature of company's business................................
Is safety your principal work?...............................
Please check other activities you engage in:

Fire protection	Legal
Health and sanitation	Insurance
Workmen's compensation and claims	Welfare
General executive (such as manager or superintendent)	Educational
Engineering (other than safety)	Industrial relations

How long have you been in your present position? ....
Technical or other special education?.........................

Signed..
Title..

EMPLOYMENT BUREAU

Situations Vacant

Town Engineer.

Applications will be received until February 10th 1922 for position of Town Engineer for the town of Oshawa, Ont. Applicant must bee xperienced and thoroughly capable of taking charge of all branches of municipal work. Apply giving references to F. E. Hare, Town Clerk.

Members Exchange

Transit and Level for sale

Keuffel & Esser Transit:—6½″ Hor. Limb, 5″ Vertical Arc. and 11½″ telescope. In first class condition. If new, catalogue value would be $507.00.

Keuffel & Esser Level:—15″ Y Level. In first class condition. If new, catalogue value would be $254.00.

Two Split Tripods:—All may be examined at Keuffel and Esser, 5 Notre Dame Street, West, Montreal. Apply Box 20-A

Tenders.

Tenders will be received from manufacturers up until noon March 1st, 1922 for Dual Drive, 100 K.W., D.C. Generator, 3 wire, 125-250 volt, one drive to be E.H.N.C. turbine, the other 2 phase, 60 cycle, 2200 volt motor. Plans and specifications can be obtained from the office of A. R. Greig, M.E.I.C., Superintendent of Buildings, University of Saskatchewan, Saskatoon, Sask.

ELECTIONS AND TRANSFERS

At the meeting of Council held on January 17th, 1922, the following elections and transfers were effected:—

Members

John Fawcett Bell, Commander-Engineer in charge of H.M.C.S. Aurora and fleet engr. officer, Halifax, N.S.

Edward Victor Buchanan, gen. mgr., Public Utilities Commission, London, Ont.

Charles Frederick Draper, B.A.I., Trinity College, Dublin., res. engr., C.P.R. cantilever bridge, St. John, N.B.

Frederick William Farncomb, private practice, London, Ont.

Donald Ernest Grant, in control of all activities of the Armstrong group of firms in North America, Montreal, Que.

Thomas Montgomery, chief engr., Sarnia plant, Imperial Oil, Limited, Sarnia, Ont.

Associate Members

Reginald deBruno Austin, Secretary, Turbine Equipment Co. Ltd., Toronto, Ont.

Charles Walter Brown, B.Sc., (C.E.), Univ. of N.B., engr., J. A. Grant & Co. Ltd., Engrs. and Contractors, St. John, N.B.

Robert Edwards Butt, dftsman.. Canadian Westinghouse Co. Ltd., Hamilton, Ont.

Harold Belbin Fisk, gen. mgr., Walsh Plate & Structural Works, Ltd., Drummondville, Que.

Noel Faure Harrison, Manitoba Power Commission, Winnipeg, Man.

Joseph Albert Laniel, asst. engr. Dept. P.W. Canada, London, Ont.

Thomas Ernest McGrail, engr., C. A. Dunham Co., Ottawa, Ont.

William Andrew Robinson, (Grad. S.P.S. Univ. of Toronto), district engr., Good Roads Board, Winnipeg, Man.

William Gordon Scott, B.Sc., McGill Univ., plant engr., Northern Electric Company, Montreal, Que.

Sidney Snell, gen. mgr. and engr., British American Fuel & Metals Ltd., Toronto, Ont.

John LeMoirrey Tait, consltg. engr., St. Lambert, Que.

James Weir, B.Sc., (McGill Univ.), asst. professor of geodesy and surveying, McGill University, Montreal, Que.

Samuel Raymond Weston, B.Sc., (Univ. of N.B.), asst. chief engr., N.B. Electric Power Commission, St. Johns, N.B.

Associates

William Charles Franz, President, Algoma Steel Corporation, Sault Ste. Marie, Ont.

David Livingstone McKeand, asst. director, Northwest Territories and Yukon, Department of the Interior, Ottawa, Ont.

Donald Minto McLean, Dominion Engineering Works, Ltd., Montreal, Que.

Juniors

Arthur Dale Bishop, B.S. (C.E.), (Univ. of Vermont), dftsman., Canadian Bridge Co. Ltd., Walkerville, Ont.

Jean B. Garneau, Bach. in Surveying (Laval Univ.), chief of Laboratory for testing materials, Dept. of Highway, Prov. Govt., Quebec, Que.

Wilder Clifford Goodwin, field engr., St. John Dry Dock & Shipbldg. Co., East St. John, N.B.

Charles A. Grupp, office man, Dept. Public Highways of Ont., at Waterdown, Ont.

Francis Stewart Hartle, of Winnipeg, Man.

Thomas Haliburton Henry, B.Sc. (McGill Univ.), asst. engr. J. P. Porter, Standifer & Porter Bros., St Catharines, Ont.

Francis Joseph Igoe, (Rensselaer Poly. Inst.), Chemist, Canadian General Electric Co., Peterborough, Ont.

George Dean Maxwell, B.A.Sc. (Univ. of Toronto), demonstrator in drawing, Faculty of Applied Science and Engineer, University of Toronto, Ont.

William Cecil Elwood Robinson, of Coldwater, Ont.

Keltie Wilson, instr'man., Dept. P.W. Canada, St. John, N.B.

Kenelm Molson Winslow, B.Sc. (McGill Univ.), dftsman., motive power and car dept., C.P.R. Winnipeg, Man.

Transferred from the class of Associate Member to that of Member

Ewart Gladstone Horne, B.A. (Dartmouth Univ.), vice-pres. and managing director, Lockewood Greene & Co., of Canada, Ltd., Montreal Que.

Percy Oscar Gordon Janes, vice-pres., gen. mgr., and chief engr., Canadian S.K.F. Co. Ltd., Toronto, Ont.

Ibbotson Leonard, (Grad. R.M.C., Kingston), B.Sc., (McGill Univ.), vice-pres. and gen. mgr., E. Leonard & Sons Limited, London, Ont.

Louis William Klingner, (Univ. of Toronto), district irrigation officer, special projects, Baghdad, Mesopotamia.

Charles Joseph Harrison Townsend, B.A.Sc., (Univ. of Toronto), member of firm, Russell Constrn. Co. Ltd., and mgr., Drifting Sand Filter Co. Ltd., Toronto, Ont.

Transferred from the class of Junior to that of Associate Member

Alexander Alderson Anderson, (Grad. R.M.C. Kingston), B.Sc. (McGill Univ.,), asst. engr., chief engr's branch, London District, Dept. P.W., London, Ont.

Henry Gerald Angell, canal supt. in charge of the Bassano Division of the C.P.R. Eastern section irrigation project, Bassano, Alta.

Chiles Manly Barnes, checker, Lackawanna Bridge Co., Buffalo, N.Y.

Byron Conrade Berry, res. engr., sewer section, dept. of works, City of Toronto, Ont.

Paul Raymond Boese, chief engr., Nevada Northern Railway, Ely, Nevada.

Fitz James Bridges, junior engr., district engr's office, London District, Dept. P.W. Canada, London, Ont.

John Brooke Molesworth Parnell, Lord Congleton, B.Sc., (McGill Univ.), Montreal, Que.

Louis Wilfrid DesLauriers, asst. engr. in charge of designing frogs, switches and track materials, C.P.R., Montreal, Que.

Sydney Dawson Fawcett, D.L.S., topographical surveys branch, Ottawa, Ont.

Christopher Edwin Fraser, B.Sc. (Queen's Univ.), res. engr., James, Proctor & Redfern Ltd., Consltg. Engrs., Toronto, Ont.

Meliton C. Garroni, Bach. of Engr'g. and Arch'ture (Malta Univ.), office engr. and dftsman., mtce of way dept., C.N.R. Winnipeg, Man.

Walter Griesbach, B.Sc. (Queen's Univ.), office engr., The Foundation Company Ltd., Montreal, Que.

George Aubrey Jenkins, B.Sc. (Queen's Univ.), supt. in Northwest States and Western Canada, on street and highway constrn. work for Warren Bros. Company (Engineering) Laboratory, Portland, Oregon.

Samuel Ralph Keemle, chief engr., Chatham, Wallaceburg & Lake Erie Rly., Chatham, Ont.

Albert John Kelly, B.Sc. (McGill Univ.), asst. professor of surveying and head of the dept. of surveying and geodesy, McGill University, Montreal, Que.

Henry Fairweather Morrisey, M.Sc. (Univ. of N.B.), district engr., Marine Dept., St. John, N.B.

Charlie Berford Shaw, i/c of dfting office, Abitibi Power & Paper Co., Iroquois Falls, Ont.

Osborne Harris Shenstone, B.S. (Mass. Inst. of Tech.), supt., Weston Works, Massey-Harris Company, Toronto, Ont.

Ronald Harrover Stenhouse, res. engr., C.P.R., Kipawa, Que.

Harold Heard Vroom, B.Sc. (McGill Univ.), Northern Electric Co., Montreal, Que.

Transferred from the class of Student to that of Associate Member

Chester Winfield Boast, B.Sc. (McGill Univ.), of Richmond, Que.

Edgar C. Cowan, B.A.Sc., (Univ. of Toronto), munic. engr., Municipality of Springfield, for Good Roads Board, Winnipeg, Man.

Charles Hibbert Donnelly, B.Sc. (Queen's Univ.), Hydro-Electric Power Commission of Ontario, Niagara Falls, Ont.

Harry L. Dowling, B.A.Sc. (Univ. of Toronto), struct'l. Engr., Barber, Wynne-Roberts & Seymour, Toronto, Ont.

Alan Ferrier, B.Sc. (McGill Univ.), of Ottawa, Ont.

Leon Fernand Mackay, B.Sc., C.E. (Laval Univ.), divn. engr., Quebec Roads Dept., Montreal, Que.

Donald Keith Macleod, B.Sc. (McGill Univ.), i/c of installation and operation of Canadian Branch of Ohio Brass Co., Barberton, Ohio, at Toronto, Ont.

William Miles Miller, (Grad. R.M.C. Kingston), Capt., Royal Corps of Signals, Maresfield Park, Uckfield, Sussex, England.

Paul Emil Mathias Rosenorn, estimator, Graham & Windsor, General Contractors, Montreal, Que.

Francis Edward Weir, B.A.Sc. (Univ. of Toronto), asst. engr., Dept. Public Highways of Ontario, Hamilton-Queenston Highway, Beamsville, Ont.

Transferred from the class of Student to that of Junior

William Herbert Bennet, B.Sc. (Queen's Univ.), res. engr., Backus Brooks Co., Kenora Power Development, Kenora, Ont.

Edgar Jabez Buckingham, B.Sc. (Univ. of Man.), asst. dist. Good Roads Board, Winnipeg, Man.

John Campbell Elder, B.Sc., (McGill Univ.), salesman, J. A. Elder, Montreal, Que.

Lawrence Edward Cokayne Frith, B.Sc., (Univ. of Man.), Manitoba Govt. Telephones, Winnipeg, Man.

Paul Gilles Gauthier, B.Sc. (McGill Univ.), demonstrator, McGill University, Montreal, Que.

Thomas Stanley Glover, 4th year student, Univ. of Toronto, Toronto, Ont.

Douglas John Ludgate, B.Sc., (Queen's Univ.), res. engr., Schroeder Mills & Timber Co., Pakesley Ont. and Key Valley Rly. (private line).

Albert Edward Macdonald, B.Sc., (N.S. Tech. Coll.), studying for M.Sc. at McGill University, Montreal, Que.

Brouard Hunter Tyndall Mackenzie, (Grad. R.M.C. Kingston), B.Sc. (McGill Univ.), junior engr., Coverdale & Colpitts, Consltg. Engrs., New York, N.Y.

James O'Halloran, B.Sc. (McGill Univ.), asst. mech. engr., Abitibi Power & Paper Co. Ltd., Iroquois Falls, Ont.

Basil C. Salamis, B.Sc. (McGill Univ.), with Jas. Atsalinos, General Contractor, Montreal, Que.

Raynond Donald Stiles, B.Sc. (N.S. Tech. Coll.), inspr. for Jackson & Moreland, Boston, Mass., taking inventory of equipment of N.S. Tramways & Power Co., Halifax, N.S.

John LeRoy Underhill, Riviere du Loup Station, Que.

British Industries Fair

The function of the British Industries Fair is to bring buyers and sellers together and to facilitate business between them. Goods can be inspected, prices compared and definite orders placed at the Fair.

Since its inception in 1915, the British Industries Fair has grown until it is to-day the most important national trade fair in the world. For the 1922 Fair it has fortunately been possible to secure enough additional accommodation both in London and Birmingham to provide not only for the annual growth of the Fair, but also to find room for the great industries which have hitherto been exhibited at Glasgow. Textiles, however, will not be included in the 1922 Fair.

A very large number of industries will be represented at the Fair and a descriptive pamphlet containing a list of such will be mailed to intending visitors, together with a complimentary admission card, on application to the British Trade Commissioners in Canada. Their addresses are:—248 St. James Street, Montreal; 260 Confederation Life Building, Toronto; and 610 Electrical Railway Chambers, Winnipeg.

Toronto Meeting, American Association for the Advancement of Science

By Horace L. Seymour, A.M.E.I.C., Secretary of the Local Committee.

The Toronto Meeting of the American Association for the Advancement of Science and of the Associated Scientific Societies, which was held during the last week of the year just ended, was the 74th meeting of the Association, and the second time that such meetings have been held in Toronto. The total number of those who registered was 1,832, geographically distributed as shown below:—

England, Belgium and Japan.....	12
United States (including Hawaii and Philippine Islands)......	867
Canada........................	953

From the City of Toronto there were registered 686, but practically every province and state in Canada and United States was represented. A number, and probably a considerable number, attended some of the meetings without registering. And the writer had the pleasure of talking to a man of science from Denmark, who apparently forgot to register.

The object of this article is to indicate the part played by members of *The Engineering Institute of Canada* and also to indicate in some way the value of such meetings to engineers.

The meeting of the Association was held in Toronto on the invitation of the University of Toronto and the Royal Canadian Institute. The sessions were held in the various buildings of the University, the majority of the members being conveniently housed in the various University Dormitories. Meals were served in the University Dining Hall. The visitors, one and all, seemed to be delighted with the arrangements which they declared were almost ideal for a meeting of this size.

In recent years the engineering section has not been at all active. There are several reasons for this which need not be mentioned here. However, this year the section was revived, its programme being considered a very important part of the meeting of the Association. Great credit is due to the very efficient work of Mr. J. B. Tyrrell of Toronto, Vice President of the Engineering Section and Chairman at the meetings. He was ably assisted by Professors Robt. W. Angus, M.E.I.C., and Peter Gillespie, M.E.I.C., as well as by Prof. C. R. Young, M.E.I.C., who represented the Society for the Promotion of Engineering Education, which met with Section "M" (the Engineering Section).

The Engineering Programme began on Tuesday, Dec. 27th, 1921, with an address on "Natural Resources and National Welfare" by Sir Clifford Sifton, formerly Chairman of the Commission of Conservation. To relieve the fuel situation, Sir Clifford advised the coking of coal where possible from the mines of Nova Scotia and Alberta, the value of the by-products being pointed out. He expressed the belief that peat deposits would yet be found of real value.

Then followed papers as below:—

"Optical Determination of Stress Distribution in Engineering Problems," by Paul Heymans, University of Ghent.

"Return Current along Submarine Cables," by Chas. Manneback, University of Louvain.

On Wednesday morning, John Murphy, M.E.I.C., electrical engineer, Department of Railways and Canals, Ottawa, employed moving pictures to illustrate his excellent talk on "Ice Formation and Prevention with Special Reference to Frazil and Anchor Ice."

R. J. Durley, M.E.I.C., Secretary of the Canadian Engineering Standards Association, Ottawa, addressed the meeting on "Engineering Standardization".

The following papers on Mining were then delivered:

"Fifty Years of Progress in Mining in Canada," by John E. Hardman, M.E.I.C., consulting mining engineer, Montreal, Quebec.

"Metal Mining in Canada," by Thos. W. Gibson, Deputy Minister of Mines, Ontario.

"Gold Mining in Ontario," by A. F. Brigham, General Manager, The Hollinger Mine, Ontario.

"Nickel Mining and Smelting," by W. L. Dethloff, M.E.I.C., chief engineer, The Mond Nickel Company, Ontario.

On Thursday, Geo. T. Clark, A.M.E.I.C., chief designing engineer of the Toronto Harbour Commission gave an illustrated address on "Toronto Harbour Development" followed by an address on "Industrial Research" by R. A. Ross, M.E.I.C., Chairman, Honorary Advisory Council for Scientific and Industrial Research, Canada.

Other Thursday papers were as follows:—

"Railway Development in Canada," by H. K. Wicksteed, M.E.I.C., formerly chief locating engineer, Canadian Northern Railway.

"Exploration for Oil in Western Canada," by A. M. McQueen, Vice-President, Imperial Oil Company, Toronto.

"Coal Mining in Alberta," by James McEvoy, M.E.I.C., consulting coal mining engineer, Toronto.

Sir Adam Beck, Chairman of the Hydro-Electric Commission of Ontario addressed a general session on Thursday afternoon, under the auspices of Section "M" (Engineering). His subject was "Hydro-Electric Developments in Ontario". These developments, he said, had been due to the men of pure science as well as to those of applied science—the electrical and hydraulic engineers.

Following the illustrated address by D. B. Dowling of the Geological Survey of Canada on "Engineering Features of the Development of the Mackenzie River Oil Field" Friday was devoted to some consideration of the problems of engineering education.

A great deal of interest was shown in and considerable discussion aroused by the following papers:—

"Relation of Industry and the Practicing Engineer to Engineering Education," by R. C. Harris, commissioner of works, Toronto.

"Professional Engineering Education for the Industries," by Prof. Chas. F. Scott, President of the Society for the Promotion of Engineering Education.

"Engineering Education versus Vocational Training," by F. W. Merchant, director of industrial and technical education, Province of Ontario, and Dugald C. Jackson, Massachusetts Institute of Technology.

On Friday evening the meetings of the Engineering Section were concluded with a dinner. In this dinner the Geological Section joined as well as the following technical bodies:—

Society of Promotion of Engineering Education,
The Engineering Institute of Canada (Toronto Branch).
The American Society of Mechanical Engineers (Ontario Branch).
The American Institute of Electrical Engineers (Toronto Branch).
The Canadian Institute of Mining and Metallurgy (Toronto Branch).
The Society of Chemical Industry (Toronto Branch).

Among the guests at the dinner were Sir Robert Falconer, President of the Universiy of Toronto; Dr. R. T. McDougal, General Secretary, and Prof. B. E. Livingston, Permanent Secretary, of the American Association for the Advancement of Science. The engineers considered themselves extremely fortunate in entertaining such honoured guests, as several dinners of other Sections and Societies were being held on the same evening. It was on the other hand, an indication of the importance attached to the Engineering Section.

A meeting of this magnitude requires a great deal of attention to numerous details. In attending to these engineers had a prominent part. On the Local Committee, there were included the following members of the staff of the Faculty of Applied Science:—Dean C. H. Mitchell, M.E.I.C.; Professors G. H. C. Wright, J. W. Bain, J. R. Cockburn, M.E.I.C., E. W. Banting and S. G. Bennett. Horace L. Seymour, A.M.E.I.C., was Secretary of the Local Committee with A. M. Reid, S.E.I.C., as assistant.

The Toronto Meeting has meant a great deal for the advancement of science in this country. To engineers it has afforded the opportunity of meeting with men of science under very happy auspices.

The Toronto Meeting has been declared a success, and undoubtedly engineers and members of *The Engineering Institute of Canada* helped to make it so.

Meeting of Practising Engineers in Chicago

The American Association of Engineers will hold a conference of practising engineers at the Congress Hotel in Chicago on Wednesday February 22, Washington's birthday.

The tentative programme includes the following subjects:

How to sell engineering service,
Experience of the practising engineer with licensing,
(a) State reciprocity,
(b) Licensing of engineering corporations,
Publicity for practising engineers,
Cost accounting for engineering service,
Bookkeeping for an engineering office,
How to uphold the standards of services and fees,
Amendment of schedules of services and fees,
(a) Providing for other branches, such as mining and mechanical,
(b) To fit them to the practice appertaining to the several parts of the country,
Computing the practising engineer's income tax.

An invitation to attend the conference will be extended to all practising engineers whether members of the Association or not who are interested in the subjects on the program.

That the conference may be of the greatest benefit to the profession depends to a considerable extent on a large attendance and if you will announce the meeting in an early issue of your paper, we shall appreciate it.

OBITUARIES

Eugène D. Lafleur, B.A.Sc., C.E., M.E.I.C.

The distinguished career of an eminent member of the profession came to a close on December 14th last in the sudden death of Eugène Damase Lafleur, Chief engineer of the Department of Public Works of Canada.

Born at Montreal on August 5th, 1861, the son of the late Edouard Lafleur, notary and of Eliza Holmes, the late Mr. Lafleur was educated at Montreal College, afterwards taking a course in Engineering at the Polytechnic School, from which institution he graduated in 1881, with high honours, winning the Peter S. Murphy gold medal for proficiency.

For over forty years Mr. Lafleur was connected with the Department of Public Works, having entered the employ of the Government upon the completion of his studies in 1881 as assistant to R. Steckel, who was then engaged on Geodetic Surveys and Precise Levelling Operations in Quebec and the Maritime Provinces. His remarkable talent and sterling qualities soon won him the esteem and appreciation of his superiors. In a few years he became chief of party, conducting important surveys for Harbour and River Inprovements, later on supervising the construction of Departmental works in the Eastern Provinces. Following the retirement of Louis Coste in 1899, Mr. Lafleur became acting chief engineer, being subsequently appointed chief engineer, December 1st, 1904.

Mr. Lafleur had charge of the Hydrographic Survey, River St. Lawrence 1897-1898, was chief engineer of the Georgian Bay Ship Canal survey, 1904-1905 and in 1906 reported favourably on the feasibility of the P.E.I. Tunnel.

The many important public works, such as deep water wharves, graving docks, harbour improvements, etc., etc., built during the last twenty-five years throughout the Dominion bear strong testimony to the engineering ability and sound judgment possessed by the late Mr. Lafleur.

Mr. Lafleur was a Member of *The Engineering Institute of Canada* since its foundation in 1887, and Councillor of *The Institute* 1916-17-18. Members will learn with profound sorrow of the loss of one of their most sympathetic and kind hearted confrères.

Mr. Lafleur is survived by his wife, formerly Miss DuPlessis, daughter of the late T. C. DuPlessis, and three daughters, Mrs. Edouard Cholette, of Montreal, and the Misses Eugenie and Gabrielle Lafleur, living at home.

E. D. LAFLEUR, M.E.I.C.
Late Chief Engineer, Public Works of Canada.

The funeral, which took place on the 17th instant, was largely attended by the staff of the Department, the members of the Ottawa Branch of *The Engineering Institute* and by many prominent citizens of the Capital.

Thomas Drummond, A.M.E.I.C.

The death occurred early in the morning of December 22nd 1921 of Thomas Drummond, A.M.E.I.C. Mr. Drummond was born in Edinburgh, Scotland, in 1856 and came to Canada at an early age where he engaged in the profession of surveying. After having obtained the diplomas of Dominion Land Surveyor and Dominion Topographical Surveyor, Mr. Drummond graduated in 1883 with the degree of B.A.Sc., from McGill University. Following graduation Mr. Drummond engaged in his profession as surveyor and was employed on many important surveys by the Dominion Government. He was also interested in mining engineering in British Columbia, acting as a surveyor and mining engineer in connection with various Western mines.

During his later years Mr. Drummond was resident in Montreal and was prominent in promotion of amateur sport. He was a life member of the Montreal Amateur Athletic Association, one of the most prominent members of the Montreal Ski Club and an active member of the Kanawaki Gold Club of which he was one time president. He was elected an Associate Member of *The Institute* in 1899. Mr. Drummond was highly respected by all who knew him and his loss is greatly felt in Montreal.

Byron Hallock, A.M.E.I.C.

Byron Hallock, A.M.E.I.C., died at Winnipeg General Hospital, November 27th 1921. He had been a victim of diabetes for a number of years and death resulted from a complication arising therefrom.

Mr. Hallock was born 46 years ago at Forrest, Ontario; came West in 1902 and was employed by the Winnipeg city engineer as leveller; remained with the department until his death, having risen gradually to the position of field engineer, in charge of all field work in connection with construction of Local Improvements. He was elected an Associate Member of *The Institute* in October 1919.

Mr. Hallock was interested in many branches of sport. When he first came to this part of the country, he was one of the best amateur baseball pitchers, for the last fifteen years he has been one of our most prominent curlers, his greatest success being the winning of the Grand Championship and two other trophies in 1916, he served on the Council of the Manitoba Curling Association for several years. He was a great sportsman and never failed to be out after the birds when shooting season opened.

Mr. Hallock was a widower, and leaves two daughters aged 16 and 14, to mourn his loss.

Arthur E. B. Hill, M.E.I.C.

It is with very sincere regret that the Vancouver Branch advises the members of *The Institute* of the death of Arthur Edmund Breton Hill, B.A.Sc., M. Inst., C.E., B.C.L.S., M.E.I.C., which occurred at his residence 1622 Parker St., Vancouver, B.C., on Wednesday, 28th December 1921. The news of his sudden decease, which was the result of a paralytic stroke, came as a distinct surprise to many of his friends. He is survived by his wife, Marion R. Graham, and one daughter, Annie G. Hill, B.A; also two sisters, Mrs. C. H. Harrington of Sydney, C.B., and Mrs. G. W. Boggs of Vancouver, B.C. The burial took place at New Westminster.

Mr. Hill was the son of the late John Lewis Hill of Sydney, C.B., being born at Hillside, Nova Scotia. He was 76 years of age, and came of United Empire Loyalist stock, whose sterling characteristics were deeply stamped into his personality. In 1875 he graduated from McGill University and joined the engineering staff of the C.P.R. in 1881. Five years later he came to British Columbia to take a position as engineer and manager of the Coquilstam Waterworks Company, and subsequentlyde signed and supervised the construction of the waterworks system of the City of New Westminster.

He was employed on the final location and construction of the Canadian Pacific Railway when that line was being completed through the Rockies, and later spent a number of years on the construction of the Grand Trunk Pacific Terminals at Prince Rupert. He was also engaged on the original Sumas Dyking Project and the last eight years of his active life were spent in the service of the B.C. Electric Railway in the capacity of land surveyor for that Company.

In 1896 he set an example for the younger members of *The Institute,* by entering public life as alderman for the City of New Westminster, during which time he served as chairman of the railway committee.

Mr. Hill was a member of the Institution of Civil Engineers and a charter member of the Corporation of British Columbia Land Surveyors. It is interesting to note that he became a member of the Canadian Society of Civil Engineers two days after its incorporation.

During his long residence in British Columb... Hill was a keen student of its development in refe... to public works. He was the originator of the muc... discussed project for connecting the North and South shores of Burrard Inlet, Vancouver, by means of a great rock and earth filled bulkhead across the second Narrows.

By constructing such a bulkhead or causeway, he proposed to furnish unlimited facilities for highway and rail communication between the north and south shores of Burrard Inlet at practically zero grade, and at relatively low cost.

Mr. Hill married in 1890 Jane Harden Graham daughter of Hugh Graham of Huntingdon, Que., and cousin of Sir Hugh Graham. She died in 1904, leaving one daughter, Anne Graham Hill. He married in 1909 Marion Robina Graham, youngest daughter of the late Hugh Graham, by whom he is survived, also by his daughter, Anne Graham Hill, B.A.

Mr. Hill was a man of aristocratic appearance and clean, manly character. His tall, erect figure and sterling personality will be sorely missed by all his professional and business associates, among whom he was held in the very highest admiration and respect. In his death Canada has lost one more of her rugged pioneers, and *The Institute* a loyal and trusted friend.

PERSONALS

F. A. Chisholm, A.M.E.I.C., is now with the Southern Canada Power Company Limited.

V. F. Murray, A.M.E.I.C., is returning to Great Britain and will be resident in Cupar-Fife, Scotland.

A. M. ROBERTSON, S.E.I.C.
Winner of Students' Prize

Mr. Philip ... for the ... very ir...

P. ACKERMAN, A.M.E.I.C.,
Gzowski Medal Winner.

J. M. Morton, A.M.E.I.C., is now with the Manitoba Power Company, Limited, Winnipeg, Man.

J. A. Moody, A.M.E.I.C., has recently moved to West Vancouver, B.C.

R. J. Lecky, A.M.E.I.C., has returned from Porto Rico and is at present resident in Toronto, Ont.

R. G. MacKenzie, Jr.E.I.c., has been transferred by the Canadian National Railways and is now resident engineer at Stanley, Ont.

U. R. Moore, Jr.E.I.C., is at present with Division No. 4, Hydro-Electric Power Commission, Niagara Falls, Ont.

J. W. Smith, A.M.E.I.C., has been appointed structural engineer with the Toronto Transportation Commission.

E. Hughes, A.M.E.I.C., has obtained leave of absence from his employers and is at present taking a course at Alberta College South, Edmonton South, Alta.

J. M. Purcell, S.E.I.C., is now with the Anglo-Newfoundland Development Company at Grand Falls, Nfld.

Major J. C. Craig, D.S.O., M.E.I.C., has been appointed assistant chief engineer, Gold Coast Harbours and has sailed for Accra, Gold Coast Colony, West Africa.

C. G. Cline, A.M.E.I.C., of the Dominion Water Power Branch, Department of the Interior, is now resident in Ottawa, Ont.

H. S. Philips, A.M.E.I.C., for some time past in the city engineer's department of London, Ont., is now with the City of Hamilton, Ont., under E. R. Gray, A.M.E.I.C.

G. R. Heckle, M.E.I.C., formerly vice-president of D. G. Loomis and Co., has severed his connection from that firm, and has opened up an office in the McGill Building, Montreal, as consulting engineer.

Prof. C. R. Young, member of the Advisory Board of Consulting Engineers for the Detroit-Windsor bridge addressed the Hamilton Branch of *The Institute* on January 13th, on the engineering features of the project.

D. M. FRASER, M.E.I.C.,
President, Dominion Engineering Agency.

Brig.-General A. G. L. McNaughton, C.M.G., D.S.O. A.M.E.I.C., General Staff Branch, Militia Headquarters, Ottawa, Ont., has returned from spending a year in England and is at present in Ottawa.

S. R. Frost, A.M.E.I.C., was elected an alderman of the City of Niagara Falls at the recent elections. The congratulations of Niagara Peninsula Branch are extended to Mr. Frost on his success in heading the polls.

J. F. Wickenden, Jr.E.I.C., has served his connection as contracting engineer with the Horton Steel Works Limited and has joined the engineering and sales staff of The Barrett Company Limited. Mr. Wickenden expects to be located in Montreal.

E. C. Little, A.M.E.I.C., who for sometime past has occupied the position of construction engineer with D. G. Loomis & Sons, Montreal, has gone to Europe on an extended trip, at which time he proposes investigating hydro-electric development possibilities in France.

H. W. B. Swabey, M.E.I.C., recently construction engineer with Lockwood Greene and Company of Canada Limited, has organized the Service Engineering Co., of Canada, 603 New Birks Bldg., which handle a line of special engineering equipment and supplies.

At an investiture held at Government House recently, Brig.-Gen. H. N. Ruttan, M.E.I.C., a pioneer in Winnipeg military circles, was made a companion of the Order of St. Michael and St. George. Seven other local military men received the Order of the British Empire. Long service medals and the Distinguished Service Order were also awarded.

J. E. Vanier, A.M.E.I.C., has returned from a lengthy trip to Europe during which he investigated the use of lime on soils for increased crop production. Mr. Vanier has turned in a report on relative yields of the different crops, to the Quebec Government and will be pleased to supply figures to anyone writing to him at 590 Union Avenue, Montreal.

Mr. M. Fraser, M.E.I.C., who for a number of years specialized as a consulting engineer on power plant work, has organized the Dominion Engineering Agency Limited, of which he is president and managing director, with offices at 24 Adelaide Street, East, Toronto, handling electrical equipment. The firm represents the Cutter Electrical and Manufacturing Co., and Schweitzer and Conrad Inc. Mr. Fraser is a graduate of Heriot Watt College, Edinburgh, in electrical engineering.

At the meeting of Council held on January 10th the Governor General of Canada, Baron Byng of Vimy G.C.B., G.C.M.G., M.V.O., was elected an Honorary Member of *The Institute.* Lord Byng is no stranger to Canadians, having commanded the Canadian Expeditionary Force in France during 1915 and 1916. The work of Canadian engineers during the Great War was particularly noteworthy and it is particularly fitting that His Excellency has now become an Honorary Member of the representative Canadian engineering organization.

Lord Byng was born on September 11th, 1862, the seventh son of the Second Earl of Strafford. He was educated at Eton and joined the army at the age of twenty-one, his first regiment being the 10th Hussars. Lord Byng rose rapidly and was placed in command of the British troops in Egypt from 1912 till 1914. During the Great War, his advance was still more rapid, he commanded first the Cavalry Division, the Canadian Expeditionary Force and finally the Third British Army. At the conclusion of the Duke of Devonshire's term of office, he was appointed Governor General of Canada. Lord Byng has also shown an interest in the activities of *The Institute,* particularly the Ottawa Branch and we offer him a hearty welcome as our newest Honorary Member.

BARON BYNG OF VIMY,
G.C.B., G.C.M.G., M.V.O., Hon. M.E.I.C.

BRANCH NEWS

Victoria Branch

H. M. Bigwood, A.M.E.I.C., Secretary.

Report of Annual Meeting

The Annual Meeting of the Victoria Branch was held on Wednesday, 14th December 1921, at Belmont House. About twenty members were present.

Before the business of the meeting opened, an address was given by Harry Plaskett on 'Super-Helium' in the Stars'. The methods adopted at the Dominion Government Observatory were illustrated, and slides showing spectra of various stars and elements, by which such were identified, were exhibited. The different characteristics as depicted by the spectroscope was explained, and also the discoveries of great scientists who had made spectroscopy their special study.

The address which was listened to with great interest, called forth a very hearty vote of thanks, which was proposed in a fitting manner by E. E. Brydone-Jack.

After the lecture was finished, a short interval followed during which Dr. and Mrs. Plaskett and Mr. and Mrs. Harry Plaskett were introduced to the members present.

The chairman, E. G. Marriott, then called the meeting to order for the business before it: viz. the consideration of reports for the past year and the election of officers for the coming year.

F. G. Aldous and C. F. P. Faulkner were named the scrutineers to count the ballots for officers.

The treasurer, E. P. Girdwood read his financial statement, duly audited, which was adopted.

H. M. Bigwood, secretary, read his report of the year's work, which was also adopted.

Reports from the conveners of the committees on Papers and Branch By-Laws were received.

The result of the ballot for officers was now announced by the chairman, as follows:—

Chairman, P. Philip, A.M.E.I.C.

Vice-Chairman, E. F. Cooke, A.M.E.I.C.

2 Executive members, E. E. Brydone-Jack, M.E.I.C., J. P. Forde, M.E.I.C.

Treasurer, E. P. Girdwood, M.E.I.C.

Secretary, H. M. Bigwood, A.M.E.I.C.

The Chairman congratulated Mr. Philip upon his election, and he also complimented the Branch upon its choice. He knew that the Branch could not be in better hands than those of the gentlemen who had been chosen to guide it during the year, he also expressed his pleasure that the Secretary had decided to remain in that arduous position for a further period. He now had great pleasure in calling upon the new chairman.

Mr. Philip, in taking the chair, thanked the members for the great honour shewn him in electing him to the very important position of Chairman of the Branch, which was second to none in importance. He wished to propose a very hearty vote of thanks to Mr. Marriott and his fellows on the executive, for the very able manner in which they had conducted the Branch during the past twelve months. The proposal was carried after other members had also added their mede of praise, and was replied to in a few words by the retiring Chairman and Secretary.

Vancouver Branch

P. H. Buchan, A.M.E.I.C., Secretary-Treasurer.

H. Rindall, M.E.I.C., district engineer of the Canadian Pacific Railway at Vancouver, B.C., has been loaned to the City of New Westminster for a week to make an independent report on the problem of rebuilding the pipe-lines which supply the New Westminster waterworks from Lake Coquitlam.

During the abnormal rainfall accompanying the storms of the last week in October, the Coquitlam river overflowed, and carried away approximately two miles of both pipe-lines. The destruction was complete and necessitated the rebuilding of the washed-out portions involving heavy expenditure which the city is having considerable difficulty in financing. In the meantime the water situation is serious, even though the neighbouring municipalities have been rendering every assistance in their power, at considerable voluntary inconvenience to their residents. The problem as yet does not appear to have met with a satisfactory solution either from an engineering or financial standpoint; hence the report of Mr. Rindall will be received with no little interest by the public and the engineering profession.

Calgary Branch

Arthur L. Ford, M.E.I.C., Secretary-Treasurer.
Floyd K. Beach, A.M.E.I.C., Branch News Editor.

Annual Banquet

The annual banquet held on December 30th at the Board of Trade was a function which has rarely been equalled in the history of the Branch. Teamwork on the part of the executive and programme committees and a number of other members may be given the credit for its success.

The menu and toast list, appearing as blue prints neatly tied in blue ribbon, were prepared by W. J. Gale, A.M.E.I.C. B. L. Thorne, M.E.I.C., chairman, called on George W. Craig, M.E.I.C., to act as toastmaster, and after the toast to the king was drunk, the following toasts were heard.

The veteran engineer, proposed by V. Meek A.M.E.I.C., acting commissioner of irrigation, and responded to by Lewis Stockett, M.E.I.C.

The civil engineer, proposed by R. S. Trowsdale, A.M.E.I.C., and responded to by J. A. Spreckley, A.M.E.I.C., and by R. S. L. Wilson, A.M.E.I.C., professor of civil engineering at the University of Alberta.

The mechanical engineer, proposed by L. F. Fyles, A.M.E.I.C., and responded to by J. F. McCall, A.M.E.I.C.

The mining engineer, proposed by A. Griffin, M. Am. Soc. C. E., and responded to by B. L. Thorne, M.E.I.C.

The electrical engineer, proposed by A. S. Chapman, A.M.E.I.C., and responded to by H. J. McEwen, A.M.E.I.C., and by R. B. Baxter, of the Alberta Telephones, a councillor of the Alberta Association of Professional engineers.

The prospective engineer, proposed by P. Turner Bone, M.E.I.C., and responded to by Stuart Dawson, student at the University of Alberta and a son of A. S. Dawson, M.E.I.C.

Angus Smith, M.E.I.C., newly elected commissioner of the city of Calgary thanked the engineers for the support they gave him recently when he was elected to a very important post in the city.

Our guests, proposed by B. L. Thorne, M.E.I.C., and responded to by P. L. Naismith, manager of the Canadian Pacific Railway department of natural resources.

Interspersed with the toasts were songs by G. H. Patrick, A.M.E.I.C., W. J. Gale, A.M.E.I.C., and others, and popular songs by the gathering led by A. S. Chapman, A.M.E.I.C.

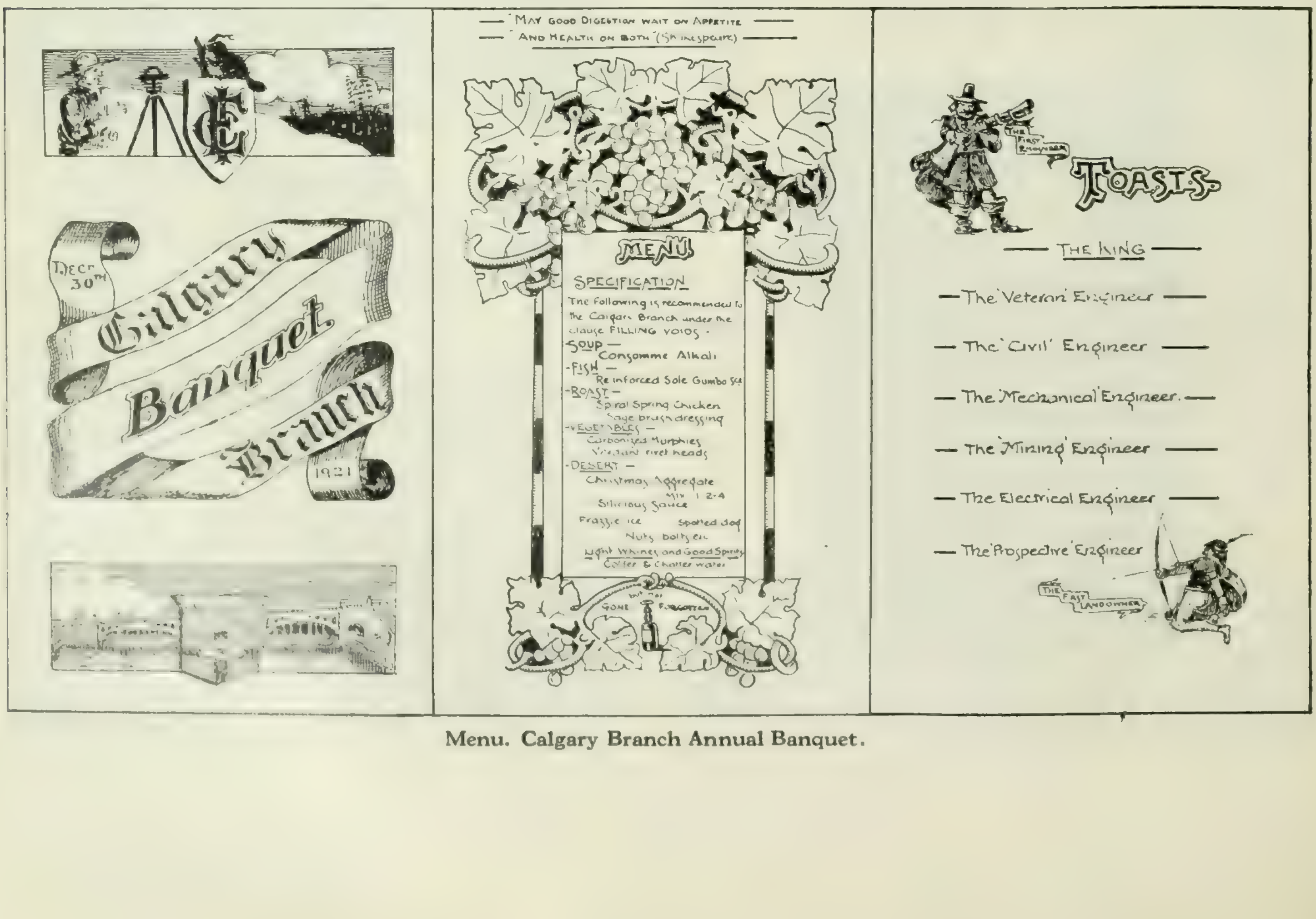
With such a toast list it is possible to touch on only a few of the many valuable remarks. The whole sense of the meetings was an appreciation of the place in our social fabric occupied by the engineer — not merely the civil engineer, but by engineers of all kinds.

A number of outsiders were specially invited, among them a number of students in the University of Alberta, and the toasts and their responses gave the visitors an outline of the aims and aspirations of *The Institute*.

The Institute so recently ceased to be merely a society of civil engineers and widened its scope to include all branches that many still have too narrow a view of its activities, and the banquet assisted materially in spreading the idea of its present breadth of outlook.

The tribute paid to the civil engineer by R. S. Trowsdale was to the point. Coming from a mechanical and electrical man of high standing in his branches, it was a valued appreciation. He cited as an example of the achievements of this branch of engineering, the Queenston Chippawa hydro-electric project, which while calling for great talent in mechanical and electrical lines, would have been impossible without the talent of the civil engineer.

Professor Wilson in replying spoke of the training of the civil engineer and pointed out that he could hope to turn out a man with a mere ground work for his calling. The real engineer must follow only after some years of application of the underlying principles taught in college.



Menu. Calgary Branch Annual Banquet.

B.L. Thorne, M.E.I.C. touched on some of the problems to be met by the mining engineer in Alberta. Among them is the difficult problem to be solved if platinum is to be recovered from the Red Deer river, owing to the small part by weight or size contained in the raw ore.

R. B. Baxter spoke very ably on some recent achievements in telephone communication in the province, including automatic dialing from the Calgary office to any subscriber in Edmonton or Lethbridge and vice versa as well as from a number of minor offices in the province; of carrier lines which permit four telephone conversations and sixteen telegraph messages on one copper circuit between Calgary and Edmonton at one time, and he forecasted the achievements that are to be demanded of the telephone engineer in the near future.

Stuart Dawson in replying to the toast to the prospective engineer spoke both ably and modestly. One feature, very well put, was that most of the engineering students graduate without knowing much of the activities of *The Institute* and if addressed during their student days on the aims of *The Institute*, a large number of them could be enrolled as student members to the mutual benefit of themselves and *The Institute*.

The Branch was highly honoured in the presence of P. L. Naismith, M.E.I.C. and he paid glowing tributes to the efforts of the engineer. One of the charter members of *The Institute*, Mr. Naismith joined as a student member on the formation of the Canadian Society of Civil Engineers, while a student at McGill. After graduation, he went to the United States for several years and let his membership lapse, but because of his early association, he has always felt kindly toward the members of the profession, and in his career, which has largely been one of an executive character, he has had much to do with engineers of all branches of the profession and esteems them very highly. In touching on the calibre of the men who were the founders of the original Society, Mr. Naismith pointed out some of the illustrious names that adorn the charter roll and he called on the present members to live up to the standards set by them.

On January 6th, Captain C. J. McKenzie, M.C., A.M.E.I.C., addressed the Branch on "Developments in Sanitary Engineering," giving a very carefully prepared paper which is being submitted to *The Journal* for publication.

His treatment of this very important subject was most thorough considering the limitations imposed by time for a single lecture, and much discussion was provoked

Montana Irrigation and Drainage Institute Convention

The third annual conference of the Montana Irrigation and Drainage Institute was held at Great Falls, Montana, On December 8 to 10. The convention was an outstanding success. A large number of delegates were present representing many of the irrigation projects of the state, the U. S. reclamation service, and various agricultural and educational institutions. Among the members of *The Institute* present from the Province of Alberta were:—

William Pearce, M.E.I.C., Dept. of Natural Resources, C. P. R.

A. S. Dawson, M.E.I.C., chief engineer, C. P. R., Dept. of Natural Resources.

V. Meek, A.M.E.I.C., acting commissioner of irrigation, Dominion Government.

Major H. B. Muckleston, M.E.I.C., chief engineer, Lethbridge Northern Irrigation District.

R. S. Stockton, M.E.I.C., Supt. operation and maintenance, C. P. R. Dept. of Natural Resources.

The object of this Institute is to advance knowledge pertaining to irrigation and drainage and to encourage improvement in irrigation practice and a more complete use of the water resources of the state of Montana. Many excellent addresses were delivered, and a number of irrigation and drainage problems fully discussed. One of the most interesting subjects dealt with was colonization on both dry and irrigated lands. This is one of the important problems facing the Province of Alberta at the present time. E. F. Benson, chief colonization agent of the Northern Pacific Railway, opened the discussion on this subject with a very able address. Mr. Benson stated that among settlers on new land the number of failures averaged 50%, largely because new settlers were obtained by nothing more nor less than land selling schemes. State supervision was advocated and the formation of some organization to assist the land settler both financially and educationally, also lower land prices with the terms of payment spread over a long period.

At the close of the convention, William Pearce who was called "The Grandfather of Irrigation in Montana and Alberta" was appointed an Honorary Life Member of the Institute.

Winnipeg Branch

Geo. L. Guy, M.E.I.C., Secretary-Treasurer.

E. V. Caton, A.M.E.I.C., Branch News Editor.

On Friday, the 19th. January, the annual meeting of the Association of Professional Engineers of the Province of Manitoba was held in the University Building.

The Secretary's report and reports of Committees were presented and approved. The Secretary's report showed a most satisfactory condition of the Association; there are 288 members of the Association and 21 applications are pending. The Library Committee reported on progress in the organizing of a technical library for use of members, 100 books already having been purchased.

Letters of appreciation and thanks were received from the University Faculty and Undergraduates' Association, thanking the Association for their offer of an annual scholarship.

Election of officers to replace those retiring resulted in the election to Council of:—

Messrs. George L. Guy, M.E.I.C.,
E. P. Fetherstonhaugh, M.E.I.C.,
A. A. Young, A.M.E.I.C.,
E. V. Caton, M.E.I.C.,

which together with the sitting members:—

Messrs. W. M. Scott, M.E.I.C.,
D. A. Ross, M.E.I.C.,
H. A. Dixon, A.M.E.I.C.,

constitute the Council for the ensuing year. The Council elected Messrs. D. A. Ross, M.E.I.C., President, A. A. Young, M.E.I.C., Vice-President, and George L. Guy, M.E.I.C., Secretary-Treasurer and Registrar.

Border Cities Branch

J. Clark Keith, A.M.E.I.C., Secretary-Treasurer.

The first meeting of the Executive for 1922 was held on December 21st when the following committees were appointed for the year:—

Papers and Entertainment:—
F. H. Kester, A.M.E.I.C., Chairman.
E. J. McIntyre, A.M.E.I.C.
W. J. Fletcher, A.M.E.I.C.

Membership:—
J. E. Porter, A.M.E.I.C., Chairman.
D. A. Molitor, M.E.I.C.
M. E. Brian, A.M.E.I.C.

Advertising:—
L. E. Collins, Jr.E.I.C.

Nominating:—
H. Thorne, M.E.I.C.

J. J. Newman, M.E.I.C., is the Branch Representative on the Ontario Provincial division.

The opening meeting for this year was held in the Cadillac Cafe on Friday, January the thirteenth, Chairman Geo. F. Porter, L.L.D., M.E.I.C., presiding.

All present participated in the opening exercises — a substantial dinner — and twenty-five plates were cleared with the proficiency peculiar to the profession.

The desirability of changing the night of meeting was discussed and the Secretary was instructed to send a questionnaire to each member to secure an expression of opinion from the entire Branch.

On behalf of the retiring Executive, M. E. Brian, A.M.E.I.C., presented J. E. Porter, A.M.E.I.C., past Secretary, with a memento in appreciation of the service he had rendered to the Branch during the past two years.

Engineering Legislation was discussed and the policy to be followed was placed in the hands of the Executive Committee in co-operation with J. J. Newman, M.E.I.C., Ontario Provincial Division Representative.

W. H. Baltzell, M.E.I.C., chief engineer of the Canadian Steel Corporation, addressed the meeting on the manufacture of T.N.T. The speaker kept his address remarkably free from the technical chemical phrases which would ordinarily be involved in such a paper. He dealt with its manufacture from the original source of toluol from the balsam of tolu but now obtained as a by-product from coke ovens, to its final rectification with alcohol and its packing in paper lined wooden kegs ready for shipment. By means of charts the progressive stages of manufacture of T.N.T., the sulphonation of benzine, synthetic phenol fusion and the manufacture of picric acid were clearly shown. Very interesting comparisons were drawn in the total quantity of ammunition used in the American Civil War and in single battles in the battle area in France. The destructive effects of aerial bombs and long range guns were clearly presented. The amount of high explosives manufactured in the U. S. for commercial purposes in 1909 was about one half the quantity used by Great Britain during four years of war.

D. A. Molitor, M.E.I.C., contributed further to a profitable evening by giving the Branch a paper on "The Evolution of Matter in the light of Modern Science". It has seldom been the privilege of the members to listen to a more interesting paper. It dealt with a subject, ultra-scientific in its nature, delving into the realms of probability on the formation of elements and compounds from the protyle, which antedated the nebulae, to the present time. The time for the formation of various elements and compounds ranged from billions of years to a matter of minutes. An explanation was sought for the beginning and end of all things and the conclusion drawn by the speaker was that the primal form of matter was not created but that "it always was and never can be destroyed, there was no beginning and there is no end".

Both papers were thoroughly enjoyed and a hearty vote of thanks was tendered by the Chairman.

Much interest will be created in engineering circles in the Border Cities by the announcement that borings for the Windsor-Detroit Bridge piers will be commenced immediately.

Local News

On December 29th, to Mr. and Mrs. J. E. Porter — a son. Congratulations.

London Branch

Geo. C. Wright, A.M.E.I.C., Secretary-Treasurer.

O. L. Olmsted, A.M.E.I.C., Branch News Editor.

On December 21st, a regular meeting was held at which fifteen members were present. By-Laws as amended were adopted and the nominating committee elected as follows:—H. B. R. Craig M. E. I. C. was appointed representative, following the receipt of his report of the meeting of the Ontario Division.

The Secretary of the Branch was authorized to attend the Annual Meeting in January 1922, and in this connection the suggestion of the Montreal Branch Secretary regarding a meeting of Branch Secretaries was approved.

At a meeting held on Jan. 20th, the following officers were elected for the forthcoming season:—

Hon. Chairman,	Dr. J. Davis Barnett, M.E.I.C.
Chairman,	H. A. Brazier, M.E.I.C.
Vice-Chairman,	W. J. Forbes-Mitchel, M.E.I.C.
Secretary-Treasurer,	Geo. C. Wright, A.M.E.I.C.
Executive Commitee,	F. A Bell, A.M.E.I.C., Chas. Talbot, A.M.E.I.C., H. B. R.Craig, M.E.I.C.

Hamilton Branch

W. F. McLaren, M.E.I.C., Secretary-Treasurer.

Detroit-Windsor Bridge

The meeting held on January 13th in the Conservatory of Music Hall was addressed by Professor C. R. Young, M.E.I.C., member of the Advisory Board of Consulting Engineers for the Detroit-Windsor Bridge, on the engineering features of this project. E. H. Darling, M.E.I.C., Chairman of the Branch, presided.

Professor Young in introducing the subject traced the development of the present bridge project, pointing out that efforts had been made for the last 30 years to construct a bridge across the Detroit river, but without success until the present undertaking was inaugurated. Several of the previous schemes had been based on the crossing of the river between Ouelette Avenue, Windsor and Woodward Avenue, Detroit, but Charles Evan Fowler, M.E.I.C., who had been called in by a group of business men of the two cities in the summer of 1919 had shown this crossing to be financially impracticable and had proposed the crossing of the river at a narrower point lower down. The economic practicability of this gave a spur to the project, resulting in necessary legislation being secured at Ottawa and Washington and in the formation of the American Transit Co., and the Canadian Transit Co., to undertake the work jointly. Mr. Fowler, who had developed the essential features of the design for a wire cable suspension bridge of 1803 ft. central span by this time, asked that an Advisory Board of Consulting Engineers be established to pass upon the preliminary design and on other points of design and construction as they might arise throughout the work. This board, of which Mr. Fowler is chairman and chief engineer, consists of George H. Pegram, chief engineer, Interborough Rapid Transit Co., New York; Professor Wm. H. Burr, consulting engineer, New York; Lieut.-Colonel C. N. Monsarrat, M.E.I.C., formerly Chairman of the Board of Engineers of the Quebec Bridge and Professor C. R. Young, M.E.I.C., of the University of Toronto.

In referring to the economic basis for a bridge at this crossing, the speaker pointed out that a large increase in traffic might normally be expected within the next few years, in view of the very rapid rate of increase in population of Detroit and the Border Cities. It is a well known fact, he said, that traffic normally increases at a much more rapid rate than population. Thus, steam railway traffic for Canada from 1901 to 1919 increased, so far as passengers are concerned, over twice as fast as the population, whereas, in the matter of freight, it increased over three times as fast. The electric railway traffic during the same period increased eight times as fast as the population. For the United States, during this period, the steam railway passenger traffic increased five times as fast as the population and the freight traffic four times as fast. The vehicular traffic across the East River Bridges at New York city increased from 1912 to 1919 over twelve times as fast as the population did for Greater New York, although no additional facility had been provided during the period. The passenger ferry traffic across the Delaware River between Philadelphia and Camden between 1900 and 1920 increased over four times as fast as the population, while the vehicular traffic increased nearly four times as fast. Between San Francisco and the opposite cities of Oakland, Berkeley and Alameda, the passenger ferry traffic, despite the discouraging eight-mile trip, increased during the period between 1912 and 1920 over twice as fast as the population. With the provision of a new facility for crossing the Detroit river, the speaker asserted, the rate of increase of traffic, even though it must cross the international boundary, should be very large. As an instance of what happens when an attractive new traffic facility is offered, the speaker referred to Toronto-Hamilton Highway on which the vehicular traffic had increased from 1914 to 1920 by 1,520%.

Professor Young discussed in some detail the alternative types of structure that had been considered by Mr. Fowler in making his recommendation of a wire cable suspension bridge for this crossing. While the cantilever type possesses great rigidity, it is essentially uneconomical for the existing situation. An interesting corroboration of the results of the comparative study of the cantilever and suspension types has occurred, said the speaker, in the publication of the report of the Board of Engineers for the Philadelphia-Camden bridge. Very careful comparative estimates have shown for that structure the cantilever type would cost over 7% more than the suspension type. Other disadvantages of the cantilever for the Detroit-Windsor crossings are that a longer span would be necessary for it than for a suspension bridge to obtain the same clear waterway with a minimum height of 110 ft. at the harbor lines, the curvature necessary on the Detroit approaches beginning with the main piers could not be obtained, and the constructing of a highway bridge which might later be transformed into a combined highway and railway bridge would be impossible.

While the arch type had appealed very much to Mr. Fowler in his original studies, he had not felt like taking the chance of recommending its adoption for a span so much greater than any that had actually been built heretofore. The Fidler, or am Ende, type of three-hinged arch actually works out to be a very economical structure, but the hazards of erection and the absolute necessity of having rock foundations had rendered its adoption inadvisable.

The speaker described, with the aid of many slides, the various forms of suspension bridges to which consideration had been given. Because of the necessity for a curved approach on the Detroit side, it was necessary to employ a structure with unloaded back stays, and this incidentally contributed to the rigidity of the main span. Two-hinged stiffening trusses are proposed in preference to three-hinged ones, because of greater rigidity, and pivoted towers have been adopted so as to obviate the large bending moment with towers fixed to the masonry. The weight of these hinged towers had actually worked out to be less than half that of fixed towers. The articulated anchorage proposed for this structure was described by the speaker as a most economical type of construction where rock foundations are available.

Full justification for the adoption of wire cables as against braced eye-bar cables was given by the speaker. He pointed out that as eye-bar cables would weigh nearly

three times as much as wire cables to carry the same stress and the pound price erected of such cables would probably not be less than three-fourths of that for wire cables, eyebar cables themselves would cost much more than those of wire and would impose a heavier load on the towers, piers and anchorages. The uncertainty concerning the erection of such cables which had not been employed on any structure with a span having a greater length than about half of that of the Detroit-Windsor bridge ruled out cables of this type.

Discussing details of the design, Professor Young explained the factors that had governed the adoption of the cross section, instancing the experience of those in charge of the East river bridges of New York with respect to the value of roadways with various numbers of lanes of traffic. He discussed the relation of the adopted loadings to the working stresses comparing them with loadings and stresses adopted for similar long span bridges.

Discussion of the address followed, in which E. H. Darling, M.E.I.C., Chairman of the Branch, R. K. Palmer, M.E.I.C., chief engineer of the Hamilton Bridge Works Co. Ltd., and F. W. Paulin, A.M.E.I.C., vice-president and manager of the Canadian Engineering and Constructing Co., took part.

Toronto Branch

F. B. Goedike, M.E.I.C., Secretary-Treasurer.

C. R. Young, M.E.I.C., Branch News Editor.

Highway Construction in Ontario

The first meeting of the Toronto Branch after the holidays was held on January 12, when Hon. F. C. Biggs, minister of public works and highways, Ontario, and Geo. Hogarth, M.E.I.C., chief engineer of highways, spoke on highway development in Ontario.

Hon. Mr. Biggs in addressing the meeting confined his attention to a discussion of the policy which was being developed by the Ontario government in the matter of highway development. He described the difficulties experienced twenty years ago by those who were endeavouring to create good road sentiment in the province. Although the "Highway Improvement Act" had established an advantageous system of aid for municipalities wishing to improve their roads, there were many cases of by-laws submitted for the purpose of undertaking good roads work defeated at the polls.

A strong effort is now being made, said Hon. Mr. Biggs, to reconstruct the important roads to carry the heavier and denser traffic that now exists. Primary attention is given to the problem of drainage and subbase, although the public is not aware of the wisdom of this plan, and clamors for a hard-surfaced road at once. There are now about one hundred miles of highway in the provincial system about to the point where hard surfacing can be provided and credit thus derived for the work already done. The minister expressed the hope that the construction record of seventy-five miles during 1921 would be exceeded in 1922.

The speaker paid a tribute to the services of engineers in the work of his department, and reminded his hearers that he had been instrumental in having a measure put through the House whereby all county road superintendents must be graduate engineers. He outlined the system of organization maintained in the department for handling the 1800 miles of provincial highway.

Matters of importance requiring attention, according to the minister, include the separation of grades at dangerous level crossings and the carrying of lights on all vehicles at night. The possibility of legislation on the latter question was pointed out.

The value of good roads in maintaining an equable market for perishable products was stressed by the Hon. Mr. Biggs. It now happens that producers, in order to avoid the muddy season, force perishable commodities on the market too early, thus congesting it and creating a period of scarcity at the time when normally such products would be plentiful. He looked forward to the time when Niagara fruit would be laid down in Toronto by motor the morning after it was picked. The economic range of the motor vehicle, said Hon. Mr. Biggs, is about one hundred miles, whereas with the horse-drawn vehicle it is only eight or ten miles. He was of the opinion that in the next ten years freight would be handled very commonly by motor truck for distances of fifty or sixty miles.

Mr. Hogarth confined his address to the methods of construction of the provincial highways. Cross-sections of typical roadways were displayed by lantern slides and many excellent views of roadways, both before and after reconstruction, were exhibited. The equipment and methods of placing the material as well as the side drainage and elimination of sharp curves and heavy grades were fully discussed. Previous to the meeting, Hon. Mr. Biggs, W. A. McLean, M.E.I.C., deputy minister of highways, and Mr. Hogarth were entertained at dinner by the Executive of the Branch.

At the meeting of the Executive held the same evening, the Chairman and Secretary of the Branch were appointed to attend the annual meeting of *The Institute* in Montreal, on January 24-25.

Revision of Branch By-Laws

At the meeting on January 19, J. M. Oxley, M.E.I.C., Chairman of the Branch Committee on by-laws, gave notice that he would move at the next regular meeting of the Branch that certain amendments to the by-laws be made. These, he explained, were necessitated generally by the present policy of ending the winter session about the middle of March. As a result, the date of the annual meeting provided in the existing by-laws, and other dates depending thereupon, required to be changed. An informal preliminary discussion of the proposed changes took place, in which A. H. Harkness, M.E.I.C., R. O. Wynne-Roberts, M.E.I.C., Wm. Storrie, M.E.I.C., F. B. Goedike, A.M.E.I.C., C. R. Young, M.E.I.C., and others took part.

Construction Industry in Canada

Following the discussion of by-laws, H. W. Pepper of the MacLean Building Reports, Ltd., addressed the

Branch on the condition of the construction industry in Ontario, illustrating his remarks by a large chart showing the variation of the volume of construction from 1910 to 1921. According to the speaker, the construction industry ranks above any other in Canada, except agriculture, and is the greatest single industry in terms of the amount of labour employed. He stated that because of the high cost of materials and labour, there was now a deferred volume of construction amounting to one and one-quarter billion dollars which would, sooner or later, have to be overtaken. The excellent technical position in which the construction industry now found itself, said Mr. Pepper, was bound to result in great activity, once public confidence is restored. That this activity has shown signs of arrival is indicated by the fact that the volume of construction for December, 1921, is over double the amount for the same month in any of the preceding three years.

Mr. Pepper discussed at length the trend of prices of construction materials and of common labour, pointing out that labour was only about 10% under its peak price for 1920, whereas materials were off about 50%.

J. M. Oxley, M.E.I.C., supplemented the address of Mr. Pepper by exhibiting a chart showing the variation of the Engineering News-Record construction cost index from 1913-21, the variation of wages for common labour and the variation of the cost of living for the same period. It was pointed out by Mr. Oxley that labour is now obtaining in terms of the cost of living one and one-half times that which it obtained in 1913.

On account of the illness of the Chairman of the Branch, Wm. Storrie, M.E.I.C., Vice-Chairman, presided at the meeting.

At the Executive meeting held prior to the general meeting, the report of the Library Committee was received, and a grant of $125. made for purposes of carrying out necessary extensions to the library.

Ottawa Branch

F. C. C. Lynch, Associate E.I.C., Secretary-Treasurer.

The close of a year of exceptionally satisfactory results was celebrated on the evening of the 12th January by a gathering of about 100 members of the Ottawa Branch of *The Engineering Institute of Canada*, the occasion being the Annual meeting of the Branch. Lieut.-Commander C. P. Edwards, M.E.I.C., the retiring Chairman, presided and presented a report which was received with many expressions of appreciation. Commander Edwards stated that the Branch had held four luncheons and twelve evening meetings during 1921, and that among those who addressed the meetings were Senator Robertson, Hume Cronyn, ex-M.P., and J. M. R. Fairbairn, M.E.I.C., President of *The Engineering Institute of Canada.*

The report further showed the impetus and support which the question of legislation to protect the public and the engineer had received and emphasized the need of consistent effort to bring all provinces in line. The success of the first year of the Professional Institute of Civil Servants was a reminder of the useful part played by many engineers in the Government Service in the growing and useful organization.

From the financial standpoint, the situation of the Branch was shown to be sound and healthy, the treasurer's report showing a substantial balance. The membership has been well sustained, forty-one new members having been accepted during the year.

The Chairman's remarks regarding the valuable assistance rendered by the local press in regularly and faithfully reporting the activities of the Branch during the year were unanimously endorsed by the members, and a motion was adopted thanking The Ottawa Journal and The Citizen for courteously opening their columns for this purpose. Appreciation was also expressed of the courtesy of Dr. William McInnes, Director of the Victoria Memorial Museum, for the use of the hall in that building, and to R. S. Peck, Director Exhibits and Publicity Bureau, Dept. of Trade and Commerce and Mr. J. B. Harkin, Commissioner of Dominion Parks, Dept. of the Interior, for valuable assistance in making the evening meetings successful by the use of motion pictures.

The officers elected for the coming year were as follows:—

Chairman, K. M. Cameron, M.E.I.C., assistant chief engineer, Dept. of Public Works; Secretary-Treasurer, F. C. C. Lynch, Associate E.I.C., superintendent, Natural Resources Intelligence Branch, Dept. of the Interior; Executive Committee:—O. S. Finnie, M.E.I.C., director, Northwest Territories Branch, Dept. of Interior; A. Ferguson, M.E.I.C., assistant chief engineer, Highways Branch, Dept. of Railways and Canals; A. B. Lambe, A.M.E.I.C., engineer, Dominion Power Board, Dept. of the Interior; C. McL. Pitts, A.M.E.I.C., engineer, Pitts Construction Company; J. L. Rannie, A.M.E.I.C., supervisor of triangulation, Geodetic Survey of Canada.

The new Chairman in outlining the activities for the ensuing year announced the "Engineers' Ball" which is to take place at the Chateau Laurier on the 26th January under the distinguished patronage of the Governor-General and Lady Byng of Vimy; also the following lectures and addresses:—

Geo. Hogarth, M.E.I.C., chief engineer, Provincial Department of Highways, Toronto, on "Good Roads"; R. J. Durley, M.E.I.C., Secretary, Canadian Engineering Standards Association, on "Standards"; Major D. H. Nelles, M.E.I.C., on "Canadian Forestry Corps in France; Col. H. C. Boyden, of Chicago, on "Concrete"; and other interesting items. The semi-technical lectures, as usual, will be illustrated by moving pictures and lantern slides and the general public will be invited to attend.

Geo. A. Mountain, M.E.I.C., chief engineer of the Board of Railway Commissioners, moved a vote of thanks to the retiring Chairman and on behalf of the Branch presented him with a large gold watch and chain which was an excellent representation of the real thing and for which Commander Edwards thanked the Branch in a few well chosen words.

On the conclusion of the regular business the meeting took the form of an entertainment, including singing, lantern slides, cartoons and two reels of motion pictures, after which refreshments were served.

President Fairbairn goes to Ottawa

Smoker

The "Smoker" was run off on schedule on January 15th, in the Palm Room of the Chateau Laurier; 225 tickets were printed and 240 engineers were packed into the room — then a "standing room only" sign was hung outside the door.

The arrangements were in charge of a committee under K. M. Cameron, M.E.I.C., assistant chief engineer of public works, and Lieut.-Commander C. P. Edwards, M.E.I.C., Chairman of the Branch, acted as Chairman in his usual happy manner.

As described in the local press, "Music and song, farce, comedy and caricatures, with a bounteous repast, all went to provide a delightful evening."

Jules Brazil, the famous Toronto entertainer, was brought specially to Ottawa for the evening and proved as pleasing and inimitable as ever. His ability to conduct community singing raised the enthusiasm of even the "refrigerating engineers" and the climax was reached when he called upon Commander Edwards to sing a song, and followed up with G. Gordon Gale, M.E.I.C., vice-president of the Hull Electric Company, and then George Mountain, M.E.I.C., chief engineer, Railway Commission.

Edwards' efforts were received with applause, Gale's with a roar, while Mr. Mountain's brought down the house with a regular ovation.

By way of variety, a one act comedy was put on by the Ottawa Drama League, entitled "Suppressed Desires," the players taking part being Miss Edith Gardner, Mrs. Louis White and W. D. Cromarty. The acting was excellent and was received with much approbation.

Local interest was provided by George Phillips, A.M.E.I.C., Inspecting engineer of the Naval Service, who sang the "Engineers' Song" and as each verse extolling, the virtues of each brand of engineer was sung, lantern slides of local celebrities in cartoon were put on the screen. It was afterwards voted that Burton Burney's reproduction of Gordon Gale, with his "service at cost" and decrepit horse, vying with Mr. George Mountain's song, was the hit of the evening.

Jef. Chapleau's slides of the evolution of the engineer, particularly the phases of "hydraulic" and "sewage disposal," were received with a roar, while the film

G. Gordon Gale in a thoughtful mood,

produced by our esteemed friend Ben Norrish, entitled "The Dancing Dusky Belles," was everything that the name implies.

It was necessary to cut short the entertainment at 11 o'clock, when an excellent supper was served in the main dining room, and all agreed that "a pleasant time was spent by one and all."

The Branch took advantage of this opportunity to entertain people of prominence, among them being Fraser S. Keith, Ben Norrish and A. McAllister, of Montreal, J. B. Hunter, Deputy Minister of Public Works, Charles Camsell, Deputy Minister of Mines, Dr. D. J. McLean, Dominion Railway Commissioner, and a few others.

The stage manager were Clarence Pitts, who under the title of "Chief Bohunk" conducted his Department with efficiency and considerable noise.

The Branch was particularly pleased to have with them Fraser S. Keith of Headquarters, and a cordial invitation is extended to him to visit us more frequently.

Montreal Branch

J. L. Busfield, A.M.E.I.C., Secretary-Treasurer.

Modern Telephone System

The 1922 season started with a regular meeting on Thursday evening, January 5th, at which Norwood M. Lash, chief engineer of The Bell Telephone Company addressed the meeting on the complexities of the Modern Telephone System. J. A. Duchastel, M.E.I.C., the Chairman of the Branch presided. In the course of his address the speaker dealt with the subject of the long distance telephone system, stating that the open wire will soon be replaced by wires in cable to care for heavy demands. The actual productive talking time on long distance was also discussed, and it is said that the time is constantly being increased as a measure of economy and

operating efficiency improved, but each advance along these lines called for bigger expenditure on new equipment. Moving pictures were used to illustrate the address. The theme taken was that of a subscriber receiving a bill and feeling very angry at the extent of it. He then fell asleep in his chair and made a journey through his own end of the phone to the connecting link at central. The subscriber in his dream managed to get through the connection of his house to the cables and carried his messages underground through intricate works until he reached the central station where he found the operators all at work, taking and distributing calls from far and near. He searched for his own line and was shown it by the superintendent.

The Town Manager Plant

On Thursday, January 12th, a departure was made in the regular Branch meetings by having a paper presented in french, with a resumé in English. Henri Ortiz, town manager of Grand'Mere Que., was the speaker, taking as his subject The Town Manager Plan. J. H. Hunter, A.M.E.I.C., presided. During the course of his address Mr. Ortiz dealt in a masterly way with the advantages of the Town Manager Plan, and explained in detail the workings of this system. He also explained how this method of City Management had grown within the last few years. Following his address, he exhibited a series of lantern slides showing the Town of Grand'Mere, and also by means of a moving picture film indicated to the audience ce the main features of the town and the surrounding country.

Explosives, and Steam by Electricity

On Thursday evening, January 19th, a joint meeting was held with the Montreal sections of the Society of Chemical Industry and of the Canadian Institute of Mining and Metallurgy. The meeting was presided over by W. G. Matheson, John T. Farmer, M.E.I.C., and Sir Stopford Brunton, A.M.E.I.C., representing the Society of Chemical Industry, *The Engineering Institute of Canada*, and the Mining Institute respectively. The meeting was held in the Queen's Hotel and preceded by a dinner, which gave the members of the different Societies an excellent opportunity of becoming acquainted. Following the dinner, Lieut.-Col. G. Ogilvie of Ottawa, chief inspector of explosives, read a paper describing the operations of the Explosive Act of Canada, following which F. T. Kalein, M.E.I.C., read a paper, illustrated by lantern slides, describing the methods of generation of steam by electricity. It is expected that this paper will be published in *The Engineering Journal.*

Quebec Branch

Hector Cimon, A.M.E.I.C., Secretary-Treasurer.

A luncheon-meeting was held at the Chateau Frontenac, on Monday the 9th of January 1922, presided over by the Chairman, A. R. Décary, M.E.I.C., and attended by 63 out of a Quebec membership of 90.

Mr. Décary, after greeting the members present at the meeting and expressing his pleasure at the large number of the members of the Quebec Branch present, said it had been decided that there should be two meetings held every month during year, at which papers would be read, and at this initial meeting, O. H. Côté, A.M.E.I.C., industrial commissioner for the Quebec Board of Trade would read a paper dealing with "The Shipbuilding Industry at Quebec, in the Last Century". He introduced Mr. Côté who spoke in French and dealt at length on the construction of wooden ships of the past which gave employment to thousands of Quebec workmen, until James Watt, by his invention, gave a death blow to sailing ships.

Mr. Côté said that the first to advocate the construction of ships in Canada was Samuel de Champlain, but it was the celebrated Intendant Talon who first started to develop this industry. He quoted from the King's expense account for the year 1671 an item regarding shipbuilding and the expenditure of 40.000 livres to be used for that industry in Canada. He then went into details of shipbuilding that followed and quoted from the late James Lemoine, in his book "Quebec, Past and Present," which records that the first ship built in Quebec to cross the ocean was modelled on the shore of the Rivière Saint Charles in the year 1703.

From information gathered in 1722, ships of a fairly good tonnage were launched in the St. Charles River from a place which was designated on the map of the city, fifty years ago, under the name of "Marine Hospital Cove". It is also near this cove that, in 1825, the famous sailing ship called the "Baron of Renfrew", of 5294 tons, with one deck and four masts and over three hundred feet long was built.

It is claimed that the title of father of the industry of shipbuilding in Canada should be given without hesitation to the Intendant Hocquart, who occupied that important position in Canada from 1729 to 1748. He was well seconded in his enterprise by Abbé Louis Lepage de Ste-Claire, Seigneur de Terrebonne.

In 1730, Abbé Lepage addressed to the Intendant a long memorandum setting forth the advantages of the industry of shipbuilding in Canada. After elaborating a vast plan of naval construction, he offered to supply the wood necessary for the enterprise at a price 50% less than the King was paying for the same wood in France.

About 1740, more important constructions were started, "man of war" frigates carrying 26 to 30 guns were built. In 1748, it is noted from the registers that a Royal Shipyard existed at Quebec, with a construction engineer in charge and all the necessary workmen, directed by Sieur Levasseur.

From 1787 to 1797 there were 173 ships built, with a total tonnage of 13,056 tons, the total value of the production in the ten years being $525,000, a very important figure if we consider that the population of Quebec, in 1790, was 14,000 inhabitants.

In 1799, the first ship was built for the commercial trade in Quebec.

The most active period of the industry was from 1800 to 1900. From the registers of the time it is seen that 2,542 ships were built here between 1797 and 1896, that is during 100 years, with a total tonnage of 1,377,079 tons, which gives an average of 540 tons per ship, the smallest being 100 tons and the largest 5,294 tons. The total value of ships built in Quebec during the last century was $55,200,000, of which $16,535,000 represented the wages paid. From 1850 to 1875, an average of 48 ships per year were built in Quebec.

Mr. Côté concluded in saying that the industry of wooden shipbuilding in Quebec exists no longer; it is a thing of the past and the workingmen of Quebec have lost a principal source of revenue.

Alex. Fraser, A.M.E.I.C., Vice-Chairman of the Branch, then moved a vote of thanks to Mr. Côté which was unanimously carried.

Mr. Décary announced that it had been arranged that the speakers at the subsequent meetings would be alternately English and French, in keeping with the spirit of entente cordiale which always existed in the City of Quebec between the French and English speaking people. He also made other comments in the interest of the profession and the holding of the next Annual and Professional Meeting at Montreal. He again expressed his pleasure at the large attendance of the members of the profession at this first luncheon-meeting.

E. A. Evans, M.E.I.C., moved a vote of thanks to Mr. Décary for the able manner in which he had presided at the meeting, and his arrangements in carrying out of the same.

The company closed by singing O Canada and God Save the King.

The next meeting is to be held on the 30th of January, at 8 p.m.; the speaker will be R. H. Nisbet, chief of the Aviation Department of Price Brothers & Company, Limited, and his talk will deal with "Aviation and Its Use by Engineers".

Moncton Branch News

M. J. Murphy, A.M.E.I.C., Secretary-Treasurer.

The Moncton Branch of *The Engineering Institute of Canada* held its monthly dinner at the Happen Inn Tea Shop at 6 o'clock, Thursday evening, December 1st, 1921.

J. D. McBeath, M.E.I.C., presided and there were about forty present including the speaker of the evening. K. H. Smith; M.E.I.C., also Dr. J. A. L. Henderson, who at the meeting of the local Branch, lectured on Natural Gas; Dr. Fred. E. Burden and Prof. Wm. McKeil, of Mt. Allison University.

Immediately after the dinner an altogether delightful vocal solo, "Joggin' Along The Highway," was rendered by Mrs. Clyde Stevens and was heartily encored. Vincent Doucet, formerly of Bathurst, but now of this city, delighted the gathering with a violin solo, "Souvenir," and also was heartily encored. Major W. A. McKee accompanied both artists and afterward rendered on the piano, the new national song "Canada", recently from the pens of George Ross, Mus. Bac., A. R. C. O., and Dr. Fred E. Burden.

K. H. Smith, M.E.I.C., chief engineer of the Nova Scotia Power Commission, consulting engineer of the New Brunswick Electric Power Commission, gave a splendid lecture on Hydro-Electric Power. This lecture he illustrated with lantern slides. In beginning his address, Mr. Smith drew the attention of his audience to the fact that in the old days in the Maritime Provinces, when a man got a grant of land from the Government, it included the waterways; the newer or Western provinces profited by their experience and do not include the streams or lakes in their grant, which clause has assisted the people of the Western provinces a great deal in their development of Hydro-Electric power.

The Waterway Commission of the Department of the Interior has over fifty stations on different streams in the Maritime Provinces, where readings are taken every day of the water flow, and are reported daily to the central office. It is essential to collect data of stream flow over a long period of years on any waterway which promises a chance of hydro-electric development.

With aid of his lantern slides Mr. Smith showed the progress of the development from maps of the country surrounding the present developments where enormous water storage is to be had, along the line of progress showing the different plants in course of construction, the dams and huge pipes which store and carry to the plants and finally the plants themselves as they look when completed. He also showed some of the machinery and of the power lines which are now in operation.

Speaking of the powei that is propoced to bring to Moncton, he said that it would come from the Musquash plant and that a power line was being surveyed now from St. John up the Kennebecasis Valley to Moncton. It had not yet been definitely settled as to the horsepower it would carry, he stated.

The lecture was a very interesting and instructive one and showed conclusively what great advantages the country will derive from this new power.

A very hearty vote of thanks was moved by Mr. MacKenzie and seconded by Mr. Tisdale and presented to Mr. Smith by S. B. Wass, A.M.E.I.C.

A regular monthly meeting of the Branch was held in the City Hall on January 19th, 1921. S. B. Wass, A.M.E.I.C., Vice-Chairman, presided.

E. G. Evans, M.E.I.C., district engineer, Canadian National Railways, read a very interesting and instructive paper on the "Toredo Navalis" ("The Ship Worm"). Mr. Evans having spent considerable time in the study of this animal was well able to go into details on his subject.

By the use of lantern slides he was able to show in minute detail the destruction that this small animal had done to different wood structures that it came into contact with; also different views of the animal itself, especially the boring and cutting shell with which it enters the wood.

After considerable discussion by the members present, the Chairman extended Mr. Evans, on behalf of the Moncton Branch, a hearty vote of thanks for the manner in which he presented so instructive a paper.

Cape Breton Branch

Kenneth G. Cameron, A.M.E.I.C., Secretary-Treasurer.

A regular monthly meeting was held January 16th, in the rooms at the Bank of Commerce Building, Sydney. The business of the evening was a paper by R. M. Mackinnon, A.M.E.I.C., city engineer of Sydney, on the "Development of Sydney's Water Supply".

At that time the City Council were about to ask for authority by means of a plebiscite for an expenditure of $150,000 on the water system,—the work to be undertaken at this time in order to alleviate the unemployment situation. The paper, therefore, was of immediate public interest, and by the invitation of the executive several members of the City Council were present, and took part in the discussion. Unfortunately the attendance of members was rather small, giving the members of the City Council perhaps rather a wrong impression of our interest in civic affairs.

Mr. Mackinnon traced the history of the City's water supply from the earliest days, when Sydney's population was only 2,500, through the time of its increasing population, and the especial period which followed the "boom". This was the period during the establishment of the Dominion Iron and Steel Company's plant here, which caused very rapid growth. At this time the original reservoir became wholly inadequate, both in capacity and head, and it was necessary to seek a new source of supply. Accordingly in 1902 another site was chosen, further up the same valley. Work was begun in the early spring on laying water pipes, constructing dykes and a concrete core dam across the narrow gorge. The clearing of the ground was begun a little later, but a portion of the site was overlaid with peat to a depth in parts of seven feet, and owing to the pressing need of the new reservoir several pockets of this were allowed to remain. These later, in 1920, gave trouble. This new reservoir, with a capacity of 200 million gallons gave ample supply to the city, which at that time numbered 12,000, with a daily consumption of 62½ gallons per capita.

There was no indication of a shortage until 1908, when a dry summer reduced the water level to its lowest limit, and the need of further extensions was apparent. Several schemes were considered, and in 1912 a severe drought produced conditions demanding immediate action. Two large lakes lying further out were connected by open ditch, and the water pumped from the lower one over the divide to the existing reservoir. This work met all needs up to a recent date, but the steadily increasing population created such a demand that in 1920 a dry summer reduced the level of the water in the reservoir and occasioned further trouble. This developed from the peat pockets referred to above, and took the form of a very strong taste and smell of decayed vegetable and fishy character. Investigation and analysis, however, showed that while decidedly objectionable in this way, the water was not actually harmful, and treatment by dissolving copper sulphate, to the extent of ten pounds to the million gallons, removed the objectionable features in a week or ten days. At the same time attention was drawn to the necessity of removing the pockets, and the work under consideration at present, is that of providing a by-pass from the supply lakes direct to the distributing system, so that the reservoir may be emptied and properly cleaned.

One or two schemes have been suggested and Mr. Mackinnon outlined a further suggestion of his own, which he had recently submitted to the City Council, demonstrating his layout on a large scale plan of the system.

Considerable discussion followed the conclusion of Mr. Mackinnon's paper, in which the members of the City Council took part. On the motion of D. S. Morrison, A.M.E.I.C., seconded by K. H. Marsh, M.E.I.C., Mr. Mackinnon was given a very sincere vote of thanks.

Following the paper and discussion, a short business meeting was held, at which the Secretary outlined the proposed conference of Branch Secretaries, and asked that all members would give this matter serious consideration, in order that the best possible results might result therefrom. The conference had been heartily endorsed by the executive committee, who considered that such a meeting should do much to co-ordinate the efforts of the Branches and forward the interests of *The Institute.*

Town Planning Notes and Comments

Horace L. Seymour, A.M.E.I.C.

NOTE: — *In order to make this column of wide interest to members of The Institute, personals and items of town planning interest will be appreciated. Address: Horace L. Seymour, A.M.E.I.C., 40 Jarvis Street, Toronto.*

Education in Town Planning

To the students in the Social Service Course at McGill University, Messrs. Buckley and Cromarty of the Federal Town Planning Division, Ottawa, are lecturing on Housing and Town Planning.

The short course in Civics and Town Planning at Toronto University is now being held with a registration of some fifty members. These are from various places in Ontario, as well as from Toronto itself and besides students, practising architects, engineers and surveyors, there are several civic officials. The experiment seems assured of success and those attending seem well pleased with the opportunities afforded. During or after the lectures there is generally free and pertinent discussion. The course comes at an opportune time, as interest in town planning is being evidenced to a greater extent than ever before.

American Society of Civil Engineers

The writer received recently a notice of meetings of the American Society of Civil Engineers, New York

City, to be held early in January. The programme for the meetings indicates the interest that is being evidenced in that technical Society in the matter of Housing and Town Planning. The subjects were as follows:—

The National Housing Problem; Broad Economic Phases.
Planning and Zoning.
Utilities.
Legislation and Finance.

Nearly all those mentioned as taking part in the programme are men who have made their names in the Housing or Town Planning world.

It is encouraging to note that considerable interest in Town Planning is being evidenced in several of the Branches of *The Engineering Institute of Canada*, so that in this respect we are, at least, keeping up with our cousins across the border.

Town Planning in Salonika

In August, 1917, some of us probably remember that Salonika was totally destroyed by fire. At least, so few buildings remained that it was decided that they might be ignored in the preparation of a new plan. Here was an opportunity for the town planner to plan *de novo*. Apparently the opportunity has been well used.

In the "Town Planning Review" for December, 1921, there is found an article that deals with the Salonika Town Planning Act. The Greek Government appointed a commission of English and French Town Planning experts to prepare a town planning scheme, while a Town Planning Act and other legislation was drafted by a special commission. Important Town Planning legislation of other countries was reviewed in great detail, and recommendations were considered from various sources including the property owners. John W. Mawson, the writer of the article, who was town planning advisor to the Ministry of Communication, states that:—

> "The new Salonika may truly be said to stand for the very highest point of scientific, economic and aesthetic development yet achieved on a comprehensive scale in the construction of towns."

To compare the Salonika with the Halifax disaster, it might be mentioned that over 4,500 buildings were totally destroyed and 70,000 people rendered homeless. In Halifax the disaster in December of the same year actually destroyed only a portion of the city and while many buildings had to be repaired, new development was confined to a comparatively small area as compared with Salonika.

General Town Planning News

The reading of current literature indicates increasing activity in town planning throughout the world.

Miss Theodora Kimbal in her review of "City Planning in United States" states that ten years ago the term "City Planning" was little known and less understood. She then mentions the States that have passed laws relating to city planning and zoning and mentions the particular cities that have made progress along these lines, details of which in some instances have been described in the Engineering News-Record during the past year. There are probably a hundred cities that have zoning plans started or completed and probably over a hundred and fifty cities in the United States that in one way or another are interested in city planning problems.

Considerable progress has been made in some of the States in Australia and a recent article by Chas. C. Reade, Government Town Planner to South Australia, describes also the progress in town planning in British Malaya.

Preliminary Notice

of Applications for Admission and for Transfer

20th January 1922

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate member a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in February, 1922.

FRASER S. KEITH, Secretary.

*The professional requirements are as follows.—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option, Railway, Municipal, Hydraulic, Mechanical, Mining or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidat. has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years oe age, and must have been engaged in some branch of engineering for at least four yearsf This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects. Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits cientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

> The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

ANGUS—ROBERT, of 550 Princess Avenue, London, Ont. Born at Kingston, Ont., Jan. 11th, 1842; 1865-69, machinist ap'tice, E. Leonard; 1869-71, Haggert Bros. Agricultural Machinery (foreman for one year); 871-74, machinist, E. Leonard; 1873, also designed and superintended constrn. and install'n of waterworks in the town of St. Thomas, also supt. of Haggert Bros. at St. Thomas, designed and constructed steam engines; 1875-76, design, constrn. and install'n of waterworks for town of Sarnia; 1876-89, foreman, E. Leonard & Sons engine works; 1889-91, master mechanic and chief dftsman., Standard Oil Co., Cleveland. asst. to Herman Frasch, chemist, in the perfection of process eliminating sulphur from crude oil; 1891-1900, supt., E. Leonard & Sons; 1900 to date, consulting engineer, at present for C. S. Hyman & Sons, Tanners, London, Ont.

References: H. A Brazier, H B R Craig, E J Leonard, R W. Angus, W J. Forbes-Mitchell

BANG—CLAUS MARIUS, 161 Laviolette Avenue, Three Rivers, Que. Born at Copenhagen, Denmark, July 21st, 1882; Educ., B.Sc. (Mech.Engr.), The Polytechnical Academy, Copenhagen, 1906; 1906-08, asst., and 1908-10, senior asst., to the professor in charge of the electrotechnical laboratory, The Poly. Academy, Copenhagen; 1910-11, travelled in Europe for two travelling scholarships; 1911-12, dftsman. and engr., telephone switchboard dept., Nor. Elec. Co., Montreal; 1912-13, designing elec. dftsman. The Cedars Rapids Power and Mfg. Co.; 1914 (June-Sept.), dftsman., bridge dept., C.P.R.; 1914 (Sept.-Nov.), surveying, Foley Bros., Sudbury; 1915 (May-Nov.) and 1917 (Sept.-Nov.), designer and checker, tool design, Canadian Allis-Chalmers, Rockfield; 1915-16, designer and checker, tool design, Montreal Munition Co., Lachine; Sept. 1916-Aug. 1917 and Nov. 1917-1918, chief dftsman., on tool design, Montreal Tramways Co., munition dept.; 1918 (May-Dec.), chief dftsman. and office engr., on tool design and plant layout, Caron Bros., Montreal; 1918 to date, designer (electrical) on eng'g. staff, Wayagamack Pulp & Paper Co. Ltd., Three Rivers, Que.

References: D. E. Blair, P. E. de la Cour, O. J. Hein, A. T. Perrin, S. Svenningson, A. Wilson.

BRUNET—LEON, of Quebec, Que. Born at Quebec, Feb. 13th, 1887; Educ., C. E. Polytechnic School, Montreal, 1909; Q.L.S. 1913; 1907 (summer), N.T.C.Rly.; 1908 (summer), Dept. Public Works; 1909 to date, with the Dept. Public Works, Quebec, as junior engr., Quebec District Engr's. office, asst. engr. and at present senior asst' engr. in charge of engineering staff.

References: A. R. Decary, A. G. Sabourin, J. H. A. E. Drolet, I. E. Vallee, J. A. Buteau, T. E. Rousseau.

CAMERON—NORMAN KEITH, of 860 Waterloo Street, London, Ont. Born at Strathroy, Ont., Jan. 7th, 1883; Educ., R.M.C. Kingston, 1899-1901; 1902-04, field and office work with F. W. Farncomb, C.E., O.L.S., London, Ont.; 1905, leveller and transitman on location work in "C" district, T.C.Rly.; 1906 (July-Dec.), location transmission lines, H.E.P.C.; 1907-12, engr., Messrs. Larkin & Sangster, Contractors, Section I, Trent Canal; 1913, sub-contract from Larkin & Sangster on Section 1, Trent Canal; 1913-15, contract on section 4-A Welland Ship Canal; 1916-19, overseas; 1919-20, contracts on Cornwall Canal, Cornwall, Ont.; 1921 to date, in charge of concrete work for The St. John Dry Dock & Shipbldg., Co., St. John, N.B.

References: K. M. Cameron, H. B. R. Craig, E. B. Jost, W. J. Forbes-Mitchell, F. S. Lazier, E. G. Cameron, V. S. Chesnut, L. Sherwood.

CLENDENING-CHESTER SCOTT, of Lethbridge, Alta., Born at Walkerton, Ont., June 21st, 1886; Educ., 3 years, applied science, Univ. of Toronto; 1908-09, transitman, Detroit tunnel; 1909, Geodetic Survey of Canada; 1910-11, concrete inspr., Smith, Kerry & Chase in Ontario and City of Winnipeg plant; 1911-13, office dftsman and transitman, G.T.P.Rly.; 1914, res. engr., P.G.E.Rly.; 1915-19, overseas; 1919-20, engr. in charge revision G.T.P.Rly.; 1921 to date, res. engr., Lethbridge Northern Irrigation District.

References: H. B. Muckleston, C. M. Arnold, P. M. Sauder, E. K. Hall, M. A. Burbank, A. M. Ross, W. S. Fetherstonhaugh.

DUBUC—ANTONIO E., 326-A St.Zotique Street, Montreal, Que. Born at Nicolet, Que., Aug. 12th, 1896; Educ., Montreal Technical School, 1917; 1913-14, asst. foreman, gen. constrn. work, Special Constrn. Co.; 1910-12, ap'tice. machinist, Ames Holden & United Shoe Machinery; 1915-17, dftsman., Canadian Car & Foundry; 1918, designer, Caron Bros.; 1918-19, gen. mgr., Garage Dubuc; 1919-20, designer, Eugene F. Phillips Electric Works; 1921 to date, dftsman., Montreal Water Board.

References: C. J. Desbaillets, F. E. Field, R. W. Mitchell, F. Y. Dorrance, P. Leclerc.

FLETCHER—HUGH MURRAY, of 377 Hess Street South, Hamilton, Ont. Born at Hamilton, Ont., Sept. 8th, 1883; Educ., Grad. S.P.S. Univ. of Toronto, 1906; 1906-15, not engaged in engineering work; 1915-19, overseas. Lieut., Can Forestry Corps; 1919-20, responsible charge of diamond drilling operations, at Morrisburg, Ont., under engr. in charge, M. C. Hendry, for H.E.P.C. of Ontario; 1920 to Nov. 1921, asst. engr., Dept. of Public Highways of Ontario, latterly with J. M. Empey, res. engr. at St. Mary's, Ont.; Not employed at present.

References: M. C. Hendry, T. R. Loudon, R. E. Chadwick, A. V. Trimble, A. L. MacLennan.

FORGUES—JOSEPH ARTHUR, of 8 Montcalm Avenue, Cartierville, Que. Born at Montreal, Que., June 29th, 1892; Educ., C. E. Ecole Polytechnique, Montreal, 1915; 1917 (June-Oct.), Montreal Water Works; 1915-17, chief dftsman., A. H. Aderberg; 1917-19, reinforced concrete designing engr., John S. Metcalf Co.; 1919-20 reinforced concrete designing engr., Canada Cement Co.; 1920-21, reinforced concrete designer, J. M. Robertson Ltd.; May 1921 to date, reinforced concrete detailing engr., Montreal Water Board.

References: C. J. DesBaillets, F. E. Field, J. M. Robertson, F. Y. Dorrance, H. W. Fairlie, P. Leclerc.

FOURNIER—OVIDE CYRILLE EDOUARD, 48 Daly Avenue, Ottawa, Ont. Born at Coaticook, Que., Sept. 10th, 1890; Educ., B.A.Sc. (C.E.) Laval Univ. 1910; 1908-1909, with the Credit Munic. Canadien on waterworks; 1910-14, tech. employee, topog'l surveys branch, Dept. Interior, Ottawa; 1914-15, asst. to the inspr. of surveys (Dom. Lands) in Alberta; 1917-19, overseas; May 1920 to date, 1st asst., drainage location party, reclamation service, Dept. Interior, Ottawa, Ont..

References: G. F. Richan, J. S. Tempest, H. R. Cram, L. J. Gleeson, W. C. Gillis, W. C. Warren.

FREEMAN—MANFRED, of Lethbridge, Alta. Born at Hamilton, Ont. July 18th, 1864; Educ., mech. elect'l. course, I.C.S.; installed and operated electric plant in Lethbridge for the Lethbridge Water Works & Electric Light Co., in 1894. With this company until 1908, reconstructing their plant in 1903. 14 years as mgr. of above company, designing and erecting their plants; 1915 to date, commissioner of public utilities for the City of Lethbridge, in charge of electric light power and street railway.

References: W. H. Meech, S. G. Porter, C. M. Arnold, H. B. Muckleston.

HOLLAND—FRANKLIN ERNEST, of 4214 Western Avenue, Westmount, Que. Born at New Britain, Conn., U.S.A., Aug. 23rd, 1890; Educ., C. E. Cornell Univ. 1912; Mech. Engr'g. course, Baltimore Poly. Inst.; 1 year rodman, and transitman, Baltimore & Ohio Rld.; 7 mos. dftsman. and transitman, C.P.R.; 1½ years, asst. engr. and asst. special engr., to the President, C.P.R., Montreal; 1¼ years, 1st. Lieut., Corps of Engrs., U.S. Army; 2 years to date, sales engr., The Sherwin-Williams Co. of Canada Ltd., Montreal.

References: J. M. R. Fairbairn, J. W. Orrock, F. W. Cooper, H. B. Stuart, J. A Shaw.

INGS—ERIC IAN HENRY, of Lethbridge, Alta. Born at Charlottetown, P.E.I., March 29th, 1891; Educ., Grad. R.M.C. Kingston, 1914; 1915-19, overseas Capt., Can. Machine Gun Corps; 1920-21, dftsman, and April 1921 to date, instr'man., Lethbridge Northern Irrigation District.

References: H. B. Muckleston, C. M. Arnold, F. S. Dyke, P. M. Sauder, F. M. Wood.

JENKINSON—JOHN HAYES, of 20 Herrick Street, Sault Ste. Marie, Ont. Born at Leytonstone, England, April 10th, 1889; Educ., 4 years, Univ. of London. Passed intermediate science exam.; 1909-11, works chemist, Burt Boulton & Haywood, Silvertown, England; 1911-14, works chemist, for Dominion Tar and Chemical Co. Ltd., at Sydney, N.S. and Sault Ste. Marie, Ont.; 1914-15, works chemist, F. J. Lewis Mfg. Co., Chicago, Ill.; 1915-17, chemist in charge of rectification for The Toronto Chemical Co., Sault Ste. Marie (Benzole recovery plant); 1917 to date, mgr., The Dominion Tar & Chemical Co. Ltd., Sault Ste. Marie, Ont.

References: F. T. Gnaedinger, K. G. Ross, C. H. Speer, B. E. Barnhill, R. S. McCormick, A. W. Sinnamon, C. H. E. Rounthwaite, W. L. McFaul.

KEITH—HOMER PASHA, Box 514, Lethbridge, Alta. Born at Comber, Ont., Aug. 30th, 1883; Educ., Grad. in C.E. Univ. of Toronto, 1907; D.L.S., A.L.S., 1905 (summer), Instr'man., C.P.R., constrn., Kenora, Ont.; 1907-09, in charge of survey parties, Nor. Alta.; 1910-16, private practice, general surveying and engineering, Edmonton; 1917-20, district surveyor and engr., Prov. of Alberta; 1920 to date, dist. Highways engr., Lethbridge, Prov. of Alberta.

References: J. D. Robertson, L. C. Charlesworth, A. W. Haddow, G. W. MacLeod, F. V. Seibert.

LAPLANT—John Frederick, of Simcoe, Ont. Born at Cornwall, Ont., Sept. 26th, 1888; Educ., prelim. exam., O.L.S.; previous to 1913, asst. engr. in county and township bridge constrn. etc.; 1913, asst. to G. R. Marston, engr. in charge of disposal plant etc., town of Simcoe; 1914 to date, res. engr. in charge of munic. constrn. work under G. R. Martson, in town of Simcoe, Ont.

References: E. H. Darling, W. Chipman, A. M. Jackson, G. R. Marston, A. Timbrell, T. T. Black, F. W. Thorold, W. B. Redfern.

McCRAE—DONALD GORDON, Box 638, Lethbridge, Alta. Born at Montreal Que., Feb. 7th, 1890; 1907, with C.P.R.; 1907-09, instr'man., N.T.C.Rly.; 1910-11, dftsman., 1912-14, instr'man., C.P.R.; 1916, in charge of private drainage work, Manitoba; 1917-18, asst. engr., and 1918 to date, canal supt., C.P.R., Lethbridge, Alta.

References: A. S. Dawson, S. G. Porter, H. B. Muckleston, H. G. Cochrane,

McKENZIE—WILLIAM L., of Lethbridge, Alta. Born at Middlesex County, Ont., Nov. 10th, 1876; Educ., Strathy Collegiate Institute. Model School, 1897. 1898-1900, public school teacher; 1901-04, ap'tice electrician, Algoma Steel Corpn.; 1904-07, electrician and foreman, Electric Supply Co., Hamilton, Ont.; 1907-09, member of firm, McKenzie & Roy, electrical contracting business; 1909 to date, owner and mgr., W. L. McKenzie & Co., Electrical Engrs., Dealers and Contractors, Lethbridge, Alta.

References: S. G. Porter, C. Raley, H. J. McEwen, H. W. Meech, C. M. Arnold, G. H. Thompson, C. D. MacKintosh.

MERRICK—JAMES, of Ste. Agathe des Monts, Que. Born at London, England, Nov. 24th, 1887; 1904-07, various buildings for G. Merrick & Sons, Bldrs. and Contractors; 1907-13, supt. of constrn. for P. Lyall & Sons; 1913-14, gen' supt. on constrn. Ross & MacDonald; 1914-19, overseas; 1919-21, gen.supt., Riordon Co. Ltd.; At present, mgr., Eadie, McNeilly Constrn. Co. Ltd., Ste Agathe des Monts, Que.

References: A. K. Grimmer, G. L. Freeman, E. S. M. Lovelace, H. G. Hunter, W. L. Ketchen, C. B. Thorne.

MOORE—JOHN MACKENZIE, of 489 Richmond Street, London, Ont. Born at London, Ont., Oct. 1st, 1857; Educ., served 5 years with Robinson & Tracy, Civil Engrs., Architects and Prov. Land Surveyors; 1891-1910, engr. in charge, water work system, City of London; 1910 to date, consulting engineer and architect, London, Ont.

References: T. H. Tracy, R. P. Fairbairn, J. A. Bell, H. A. Brazier, H. B. R. Craig, E. I. Leonard, A. H. Smith.

MOREY—HAROLD ARTHUR, of 780 Wellington Street East, Sault Ste. Marie, Ont. Born at Windsor Mills, Que., Feb. 19th, 1886; Educ., B.Sc., Dartmouth Univ., 1908; 1908-09, rodman and leveller, R.P., survey, and inspector on constrn. of bldgs., Dartmouth College; 1910, in charge of engr'g. office, Lloyd & Mann, Concord, N.H.; 1910-11, dftsman., Vermont Marble Co.; 1911, dftsman., B. F. Sturtevant Co., and inspr. on replacement of bridges, Boston & Albany R.R.; 1911-12, asst-engr., Dartmouth College; 1912-13, dftsman., International Paper Co.; 1915-18, chief dftsman., Spanish River Pulp & Paper Mills Ltd.; 1918 to date, mill engr., Spanish River Pulp & Paper Mills Ltd., Sault Ste. Marie, Ont.

References: G. H. Kohl, C. H. E. Rounthwaite, B. E. Barnhill, A. W. Sinnamon, F. Smallwood.

PAOLI—AMBROSE ALOYSIUS, of Kingston Ont. Born at Charlottetown, P.E.I., July 13th, 1892; Educ., B.A. Queen's Univ. 1915. At present in 4th year civil engr'g., Queen's Univ.; 1913 (summer), rodman on city surveys, Charlottetown, P.E.I.; 1914 (summer), conduit constrn. foreman, Bell Telephone Co., Peterborough, Sudbury, Sault Ste. Marie; 1916 (May-Sept.), asst. to chief chemist, Armstrong Whitworth Co. of Canada Ltd., Longueuil ,Que.; 1916-17, testing engr. and insper., Imperial Munitions Board; 1917 (April-Aug.), melter foreman, pit foreman, testing engr. and metallurgist for British Forgings Ltd., Ashbridge Bay, Toronto; 1917 (Aug.-Dec.), night supt., Charleston Alloy Steel Co., Belle, W. Va.; 1917-18, night foreman, John A. Crowley Co., Detroit, Mich.; 1918 (May-Sept.), supt., open hearth and elec. furnace dept., Union tool Co., Torrance, Cal.; 1918-20, supt., steel and iron smelting, Moreland Motor Truck Co., Burbank ,Cal.; Sept. 1920 to Mar. 1921, furnace supt., California Electric Steel Co., Wilmington, Cal.

References: A. Macphail, G. J. Smith, W. R. Hughson, G. Hemmerick, L. T. Rutledge, W. P. Wilgar.

ROWLEY—HARRY WILLIAM, of Coaldale, Alta. Born at Byron, Mich., U.S.A., Dec. 23rd, 1887; Educ., B.Sc. Mich. Agric. College, 1912; 1914-17, district hydrometric engr., under P. M. Sauder, Dept. of Hydrometric Surveys, Dept. Interior, Calgary, Alta.; Also during summer 1917 acted as irrig. inspection engr., and dist., watermaster in conjunction with the hydrometric work; At present, district watermaster, under S. G. Porter, C. P.R., Dept. Natural Resources.

References: S. G. Porter, F. H. Peters, R. S. Lawrence, C. Raley, G. S. Brown.

RUSSELL—ALLAN HUGH, of Sault Ste. Marie, Ont. Born at Renfrew, Ont., July 12th, 1888; 1907-08, opera r in hydro.-elec. power plant and i/c of meter dept.; Renfrew Power Co., Renfrew, Ont.; 1909-12, asst. in meter dept. and operator in hydro-elec. power plant, Lake Superior Power Co., Sault Ste. Marie, Ont.; 1913-14, asst. to field engr., water power dept., Algoma Steel Corpn., Sault Ste. Marie, Ont.; 1915, senior operator, hydro-elec. power plant for above company; 1916-17, dftsman. and asst to field engr., Spanish River & Paper Mills Ltd.; 1918-21, asst. to res. engr. of Soo Mill for above company; Oct. 1921 to date, asst. to city engr., Sault Ste. Marie, Ont

References: J. S. H. Wurtele, W. S. Wilson, J. G. MacLaurin, F. T. Gnaedinger, LeR. Brown, K. G. Ross, A. E. Pickering, J. W. LeB. Ross.

RUTLEDGE—PERCY R., of 252 Trent Avenue, Winnipeg, Man. Born at Rutledge P.O., Que., May 5th, 1891; Educ., B.Sc., Queen's Univ., 1911. Vacations with Can. Westinghouse Co.; 1914-18, acting divn'l. supt., Eastern Canada, and from 1918 to date, divn. supt., Central Canada, Gas and Electricity Inspection, Dom. Govt. Member Board of Examiners under Gas and Electricity Inspection Act. Consltg. Electrical — Board of Grain Commissioners.

References: E. P. Fetherstonhaugh, G. L. Guy, L. W. Gill, P. A. Borden, E. V. Caton.

SMITH—ERNEST, of 1005-14th Avenue, Edmonds, B.C. Born at Goudhurst, Kent, England, Sept. 26th, 1883; Educ., Senior Cambridge Local Exam. Short Course, C.E., Seanley College, Kent, 1900-01; 1904, rodman, with S. B. Hall, Sumas Reclamation Scheme; 1905-06, land survey work, and road constrn. Prov. Govt. B.C.; 1907-08, topog'l., hydro'l. and instrument work under Francis LeBarron, Sumas Development Co.; 1909, instr'man., B.C. Electric Rly.; 1910-11, instr'man., Kettle Valley Rly.; 1911-12, instr'man., 1912-14, asst. engr., B.C. Electric Rly.; 1915-19, overseas, C.F.A.; 1919 (Mar.-July), instr'man., Prov. Govt. B.C.; 1920 (Feb.-March), in charge of party ,prelim. survey, B.C. Electric Rly.: March 1920 to date, engr. for the Corpn. of the District of Burnaby.

References: A. C. Eddy, F. J. Whittaker, G. H. Burnett, H. Stewardson, F. N. Sinclair, A. E. Hill.

SPELLER—FRANK NEWMAN, of Pittsburg, Pa. Born at Toronto, Ont., Jan. 1st, 1875; Educ., B.A.Sc. Univ. of Toronto, 1893; 1899-1901, mining work, Can. Bank of Commerce; 1901, Ontario Bureau of Mines; 1905 to date, metallurgical engr., National Tube Co., Pittsburg, Pa.

References: R. W. Angus, C. B. Hamilton, C. H. Mitchell, J. M. R. Fairbairn, W. J. Francis, J. M. Robertson, A. F. Macallum.

STEPHENSON—HERBERT ARMSTRONG, Box 1125, St. John, N.B., Born at St. John, N.B. June 23rd, 1890; Educ., I.C.S.; 1906-08, ap'tice., with Fred Thomson & Co., Montreal, elec. mach. repairs and install'n.; 1908-1909, asst. to supt. of electr'l. apparatus, McGill University; 1909-11, installing and repairing elect'l., controlling apparatus, Otis-Fenson Elevator Co., Montreal; 1911 to date, chief electrician, and at present vice-pres., E. S. Stephenson & Co. Ltd., Engrs. and Machinists, St. John, N.B. (Assoc. Member, A.I.E.E.)

References: F. P. Vaughan, C. H. Wright, G. H. Waring, B. Wilson, A. R. Crookshank.

TABOR—AUBREY CLIFTON, 895 Charlotte Street, Fredericton, N.B. Born at Fredericton, N.B., Sept. 10th, 1875; Educ., B.Sc. Univ. of N.B. 1897; (3 mos), rodman on location, Columbia & Western Rly., 1898-99, instr'man on constrn., Columbia & Western Rly.; 1900-01, transitman, Algoma Central Rly.; 1903-04, transitman, C.P.R.; 1899-1900, res. engr., Great Northern Rly., Spokane, Wash.; 1901-02, res. engr., Algoma Central Rly.; 1902-03, res. engr., Wabash Rly. branch lines, Ohio, U.S.A.; 1905-08, res. engr., double track, C.P.R., Winnipeg — Fort William; 1909-10 walking boss, constrn., G.T.P. Rly.; 1911-14, res. engr., Can. Nor. Pac. Rly.; 1914-15, engr., constrn. of substructures of bridges, Can. Nor. Pac. Rly.; 1917-20, transitman, C.N.R., Edmunston, N.B.; 1920-21, res. engr., constrn., Scotts branch, Quebec Central Rly. Not employed at present.

References: W. K. Gwyer, J. R. C. Macredie, H. L. Johnston, F. H. Hibbard, W. A. James, W. N. Cann.

WHITFORD—JOSEPH HUGH, of 40 Weldon Street, Moncton, N.B. Born at Bridgewater, N.S., July 22nd, 1899; Educ., I.C.S.; 1914-15 (summers), rodman, N.S. Prov. Highways; 1917-19, overseas; 1919 (Mar.-June), rodman and dftsman, for E. March, engr., for town of Bridgewater; 1919 (June-Dec.), chairman and Dec. 1919 to May 1921, rodman, C.N.R., Bridgewater; May 1921 to date, dftsman on bldg. work, chief engr's office, C.N.R., Moncton, N.B.

References: A. F. Stewart, F. B. Tapley, S. B. Wass, H. J. Crudge, J. Murphy, F. W. Forbes, J. G. Dryden

WILSON—H. ALTON, of 2662 Park Avenue, Montreal, Que. Born at Glenora, Ont., April 17th, 1890; Educ., Grad. in Mech. and Elect'l Engrg., Univ. of Toronto, 1911; 1905-11 (part time), ap'ticeship to machinists trade; 1911-13, dftsman., J. C. Wilson & Co., Glenora, Ont.; 1913, asst. tool engr., Cadillac Motor Car Co., Detroit, Mich.; 1914, engr., hydraulic turbines and power transmission machinery, J. C. Wilson & Co., Glenora; 1915-18, engr. tool designer, supt. and mgr., J. C. Wilson Mfg. Co. Ltd., Belleville, Ont., manufacturing shells, and 1918-20, engr. on all contract work for same firm; 1920-21, equipment engr., North East Electric Co., Rochester, N.Y.; At present technical editor of the following publications: Canadian Machinery & Mfg. News, Power House, Canadian Foundryman, and Marine Engineering of Canada.

References: A. Bertram, W. deS. Wilson, W. H. Winterrowd, G. E. Bell, L. T. Rutledge, F. S. Keith.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

CUMMIFORD—SHIRLEY ARMSTRONG, of 49 Wellington St. East, Toronto, Ont. Born at London, Ont., Jan. 26th, 1888; Educ., 2 years Univ. of Toronto, 1907-09; 1909-11, rodman, T. C. Rly.; 1911 (2 mos.), dftsman., and 1911-14, instr'man., T. C. Rly.; 1914 (Oct.-Dec.), instr'man., C.N.R.; 1915 to date with Toronto and Hamilton Highway Commission, as follows: 1915-16 instr'man [illegible]-May, res. engr., 1916-18, asst. to chief engr., 1918 to date, chief engr.

References: W. A. McLean, G. Hogarth, H. S. VanScoyoc, V. T. A. Belanger, H. G. O'Leary.

HAWKINS—EDWARD EWON, of Avonmouth, England. Born at Shrewsbury, England, Aug. 18th, 1883; Educ., 1900-05, Crewe Technical Institute. 1900-05, premium ap'tice, London & North Western Rly., Crewe, England; 1905-07, dftsman., leveller and transitman in charge of survey party, and 1907-13, res. engr. on various sections, N.T.C. Rly.; 1913-15, res. engr. on 100 mile section N.T.C. Rly., all bridges, large culverts and bldgs., including Doucet Divn. and yard; 1915-19, overseas. Major, Royal Engrs.; 1920-21, contractor's engr. in charge of erection of reinforced bldgs., High Wycombe & Egham, England; At present, outside supt. of constrn., reinforced concrete work, Port of Bristol, for Messrs. W. Alban Richards & Co.

References: A. E. Doucet, C. L. Hervey, H. E. Huestis, R. M. Charlton, J. H. Holliday.

MacKINTOSH—COLIN DUGALD McTAVISH, of Lethbridge, Alta. Born at Auckland, New Zealand, Sept. 24th, 1882; Educ., Civil Engr., Glasgow and West of Scotland Tech. Coll., 1905; 1899-1905, ap'ticeship, Messrs. Kyle, Dennison & Laing, Glasgow; 1905-09, rodman, dftsman., transitman and instr'man, on constrn., C.P.R.; 1909-15, locating engr., asst. engr., constrn. and divn. engr., Sask. Divn., C.P.R.; 1915-18, supt., Medicine Hat Divn., and 1918 to date, supt., Lethbridge Divn., C.P.R.

References: J. G. Sullivan, W. A. James, F. Lee, F. W. Alexander, S. G. Porter.

WRIGHT—ATHOL C., of 160 Third Avenue, Ottawa. Born at Hull, Que., Sept. 2nd, 1879; Educ., Ottawa Collegiate Institute; 1899-1903, mining and surveying. Western Ontario & British Columbia; 1903-04, leveller, Brockville, Westport & Sault Ste. Marie Rly.; 1904-08, instr'man., 1908-11, res. engr., N.T.C. Rly.; 1912-14, res. engr., C.P.R.; 1915-16, in charge of roads and bridging operations, Petewawa Internment Camp, for Dept. of Militia; 1916-19, overseas., Capt., Can. Engrs.; 1919 to date, asst. hydraulic engr., reclamation service, Dept. of the Interior, Ottawa, Ont.

References: J. S. Tempest, G. Grant, H. H. Charles, F. H. Emra, M. H. Marshall, C. L. Hervey.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

ALLEN—ROBERT WILLIAM, of Regina, Sask. Born at Middlesborough, England, April 8th, 1889; Educ., Civil Engr'g., I.C.S.; 1906-08, arch'l. dftsman; 1908-11, dftsman and rodman, City of Regina; 1912-14, chief dftsman., engr'g. dept., Regina; 1914-15, instr'man on munic. works (roadways and sewers divn.), Regina; 1916, supt., Regina sewage disposal works; 1917 to date, asst. city engr., City of Regina.

References: D. A. R. McCannel, H. G. McVean, D. W. Houston, J. M. Mackay, C. S. Cameron, W. T. Daniel.

LONGWORTHY—WILLIAM EARLE, of 2035 Hamilton Street, Regina, Sask. Born at Regina, June 21st, 1891; Educ., B.A.Sc., Univ. of Toronto, 1915; 1912 (5 mos.), 1913 (5 mos.), and 1914 (5 mos.), bridge inspr., Sask. Prov. Govt.; 1915, on prelim. survey for the Sask. Water Commission; 1916-19, overseas, Lieut., C.F.A., Awarded M.C.; 1919 to date, sewerage engr., City of Regina.

References: D. A. R. McCannel, H. S. Carpenter, R. W. E. Loucks, A. P. Linton, H. N. Macpherson, A. J. McPherson, J. McD. Patton.

LYON—ERNEST NORMAN, of Bombay, India. Born at Edinburgh, Scotland, July 21st, 1886; Educ., 1901-08, ap'ticeship with Messrs. Kyle, Dennison & Laing, Civil Engrs. and Land Surveyors, Glasgow. Certs. in mechanics and sanitary science, Heriot Watt College; 1908-10, chief asst., Kyle, Dennison & Laing; 1911-15, field dftsman. and last 39 mos. chief dftsman., C.P.R. Engr'g. Dept., Western Lines; 1915-18, Royal Engrs., Capt.; 1919, asst. engr., The North British Rly. Co., Edinburgh; 1920, engr. in charge, The Irish Glass Bottle Co. Ltd., Charlotte Quay, Dublin; At present, asst. engr., Indian Construction Co. Ltd., Bombay, India.

References: A. E. Sharpe, C. D. MacKintosh, H. C. Carter, V. Michie, H. J. DeSavigny.

PAPINEAU—AUGUSTIN JEAN, of Amqui, Que. Born at Coaticook, Que., July 12th, 1888; Educ., C.E. Ecole Polytechnique, 1909. Architect, Board of Examiners of Architects, Prov. of Man., 1914; 1909 dftsman., Western Steel & Iron Co. Ltd.; 1910-12, designer, J. A. Senecal, Architect; 1913-16, member of firm, Senecal & Papineau, Architects; 1917, estimator, J. H. Tremblay Co. Ltd., contractors; 1918-19, dftsman., Shawinigan Water & Power Co.; 1920, office mgr. of bldg. dept. for Banque d'Hochelaga; 1921 to date, local mgr. at Amqui, for St. Lawrence Lumber Co. Limited.

References: F. C. Laberge, O. O. Lefebvre, S. Svenningson, O. H. Coté, J. A. Meindl, J. A. Buteau.

WHITE—DONALD ALEXANDER, of Montreal, Que. Born at Ottawa, Ont., Jan. 30th, 1889; Educ., Grad. R.M.C. Kingston, 1909, passed prelim. exam. for D.L.S.; 1909-10, asst. engr. on staff of River St. Lawrence Ship Channel, Dept. of Marine; 1910-11, with contractor on rly. constrn. (C.N.R.); 1912-14, in business, constrn. materials, etc., Ottawa, Ont.; 1914-19, overseas, Brigade Major. Awarded D.S.O.; 1919 to date, in business in Montreal, now president, Taylor, White & Co. Ltd., Manufacturers Agents. Also employed as technical salesman for Penberthy Injector Co. Ltd., of Windsor, Ont.

References: C. J. Armstrong, F. W. Cowie, V. F. W. Forneret, F. A. Wise, F. L. Wanklyn.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

CHAUSSEE—PIERRE MAURICE, 84-A Lasalle Road, Verdun, Que. Born at Letellier, Man., Aug. 1st, 1896; Educ., Montreal Tech. Inst. 1912-14; 1914, dfting. and designing, tel. switchboards, Northern Elec. Co.; 1914-16, on complete layout of switchboards, etc., Dominion Guarantee Co. Ltd.; 1916-17, with Montreal Quotation Co. (Montreal Stock Exchange), on preparation of plans for complete layout of elect'l. install'n. for stock ticker system; 1917-20, with Electrical Comm. of the City of Montreal on engr'g. staff, in connection with constrn. of underground conduit system; May 1920 to date, chief dftsman., Montreal Water Board on design and constrn. of a new pumping station for the City of Montreal.

References: L. A. Herdt, C. J. Desbaillets, F. E. Field, F. Y. Dorrance, P. Leclerc, G. E. Templeman.

DESSANE—DESPRES, of 40 Angele Street, Quebec, Que. Born at Quebec, Oct. 1893; Educ., I.C.S.; 1914-15, surveying, subdivision of lots, etc.; 1917-18, overseer of constrn. works, highway dept., Parliament Bldgs., Quebec; 1919-20, in charge of constrn. work, highways dept.; 1920 to date, in charge of constrn. works, asst. engr. of Quebec Roads Commission of Quebec.

References: R. J. L. Savary, B. Rocher, T. E. Rousseau, J. O. Montreuil, J. P. Piché, L. G. Papineau, J. E. Gibault, J. Dumont, S. D. Desmeules.

RANCE—CHARLES CLARANCE, of 26 Albany Avenue, Toronto, Ont. Born at Kenora, Ont., July 17th, 1892; Educ., B.A.Sc., Univ. of Toronto, 1915; 1912 (summer), rodman, C.N.R.; 1913 (summer), asst. on highway work, Routly & Summers; 1914 (summer), asst. on motor survey, Essex and Kent Counties, Dept. Public Highways, Ontario; 1915 (May-Sept.), inspr. of component parts, Canadian Inspection Co.; 1915-16, chief inspr. on Primers, W. Beardmore Co., Toronto; 1916-17, district guage examiner on component guages in Toronto, and 1917-18, in charge of a staff of guage examiners on component parts in Ontario, Imperial Munitions Board; 1918-19, with D.S.C.R., making industrial surveys of manufacturing institutions to locate openings for training disabled soldiers; later in charge of "paid courses" in Ontario, vocational branch, under H. E. T. Haultain; 1919-20, asst. engr., Dept. Public Highways, Ontario; 1920 (Feb.-Aug.), in factory of United Drug. Co., Toronto, and Sept. 1920 to Dec. 1921, city salesman for same company; At present, asst. engr. in office, H. T. Routly.

References: H. T. Routly, W. A. McLean, G. Hogarth, H. E. T. Hauttain, P. Gillespie, J. E. Porter, LeR. Brown.

ROBERTSON—ANDREW MURRAY, of 2432 St. Urbain Street, Montreal, Que. Born at Keewatin, Ont., July 18th, 1894; Educ., B.Sc., McGill Univ., 1921; 2 summers, dfting dept., Northern Electric & Mfg. Co.; 1 summer, special ap'tice, C.P.R. Angus shops; 1915-19, overseas, Capt. Can. Engrs.; 1920 (May-Sept.), res. engr. on constrn. of reinforced concrete dam and power house for City of Sherbrooke on St. Francis River, employed by the Foundation Co. Ltd.; At present, divisional traffic engr., Bell Telephone Co., Montreal.

References: C. J. Armstrong, A. Macphail, H. M. MacKay, E. Brown, F. B. Brown, F. P. Shearwood, L. C. Jacobs.

ROGERS—HUBERT DAVID, of Gananoque, Ont. Born at Gananoque, Ont., July 31st, 1892; Educ., B.Sc., Queen's Univ., 1913; 1909 (4 mos.), with Gananoque Electric Light & Water Supply Co.; 1911, asst. on Geol. Survey of Canada; 1912, asst. to town engr., Gananoque, on permanent walks; 1920, concrete inspr., Kingston-Prescott section, prov. highways; Oct. 1920 to date, supt., Gananoque Waterworks and Sewerage System.

References: W. H. Boyd, A. F. Byers, D. S. Ellis, A. Macphail, W. L. Malcolm.

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Generation of Steam by Electricity

The field of use for the electric-steam generator, its advantages to the consumer from load-factor point of view and to electric supply company as outlet for surplus power; discussion of types of electric steam generator with particular reference to water-resistance type.

F. T. Kaelin, A.M.E.I.C.

Chief Engineer, Shawinigan Water and Power Co.

Paper read January 19th,1922, before a joint meeting of the Montreal Section of the Chemical Industry, The Engineering Institute of Canada and The Canadian Institute of Mining and Metallurgy.

The purpose of this paper is to bring before the engineering profession an application of electric energy and its conversion to heat energy by means of improved and inexpensive apparatus, the electric steam generator.

This paper indicates the usefulness and limitations of such apparatus in supplementing, and in some cases in replacing existing boiler plants. A description will follow dealing with the design and operation of two variations of a type of generator which have recently been put into operation in this country and which may be of interest owing to their capacity and compactness.

To produce steam by electricity appears at first sight a reversal of common sense, but by analyzing prevailing conditions of energy production, and conversion, accentuated by the existing dislocation of all kinds of productive activities, it is found that the electric steam generator is quite a useful piece of apparatus where hydro electric power is available, and which otherwise would be idle or go to waste. During the time of business depression when the engineer's activity and thinking are of necessity forced towards all kinds of improvements such as increasing efficiency of production, elimination of waste in material, labour and power, the electric steam generator is one of the means to accomplish this, being in fact a handy and simple apparatus, and bringing us nearer the goal of the conservation of energy.

Electric steam generators have been built during the last ten years in a number of European countries possessing hydro electric power, and where in the past five years the scarcity and high price of fuel favoured

the development and use of various methods of generating steam by electricity. There are more than three hundred installations known to exist in Italy, Switzerland, Sweden and France. In Canada and the United States a small number of generators have been in use for a short time. Some of these installations will be dealt with in this paper.

Advantages

Under prevailing conditions where electric power is sold on a kilowatt hour basis, electric steam generation cannot compete with steam produced by fuel, but it is not beyond the possibility that in some remote places where the cost of fuel and freight are high and the cost of a hydro electric development is low, the electric steam generator with its very low capital investment and operating expenses may become a competitor to the method of generating steam by burning coal or oil, but it is not necessary to consider such an exceptional case to prove that the generator fills well its place permanently as a transformer of idle power into useful heat energy. We may consider its usefulness mainly from two different points of view:

Consumers

1. From the point of view of the consumer of electric power owning a hydro electric installation, or purchasing blocks of firm hydro electric power on a flat rate power contract and using this power for manufacturing purposes only during a smaller part of the twenty-four hours. In many manufacturing plants steam has to be produced for cooking processes, drying, humifying, and in all cases heat is required for heating purposes during six months and during the full twenty-four hours. Here we have electric power lying idle for twenty-four hours and paid for. The thought comes to us, what can be done with this idle power? Is there any cheap way of transforming this electric power into something useful? It is well known that electric energy can be transformed into heat energy at a very high efficiency. One of the cheapest ways of doing this is to produce steam which in most cases can be used in conjunction with other steam generating apparatus, and where a system of piping for the purpose of heating or using steam for manufacturing purposes already exists.

The low cost of the steam generator compared with other electrical apparatus for the conversion of electric energy into heat, and the wiring and control apparatus necessary for such equipment, is very much in favour of the steam generator. It can be shown that even in extreme cases where the load factor is comparatively high, for instance in pulp and paper manufacturing plants using a considerable amount of power during six days of the week and having it idle for the seventh day and at the prevailing cost of hydro electric power purchased in big blocks by these companies that it is economically quite feasible to turn the power which was used during six days, mainly for pulp grinding, during the seventh day into steam which is always required in such places, either for manufacturing or heating purposes. It was shown in an investigation made lately that the saving of coal during the fifty-two Sundays and three holidays would easily pay for the installation of the steam generator in less than one year, and there are no doubt quite a number of pulp and paper plants in this country where similar conditions exist and where a considerable saving could be accomplished.

Power Producing Companies

2. From the point of view of the Power Company producing and selling hydro electric power, the present commercial depression and slowing up of the industrial activities have left hydro electric companies with surplus of power for disposal. How long this condition is going to last is uncertain but there is no doubt that a considerable amount of unused power will be available for the next two or three years. Power companies can afford to sell this power at cheaper rates during such time as there is no other market for the power, though preferably under conditions which allow the power company to cancel the contracts on short notice. But at the same time it must be clearly understood that no power company could afford to develop hydro electric power for the main purpose of generating steam electrically in competition with coal.

The problem has been to find a use for this idle power which would not require any expensive installation, new machinery or additional apparatus, for instance transformers, etc., and as it was out of the question to use the power, for new industries or the manufacture of new products which require considerable power like those produced in the electro-chemical industry, one of the solutions was to turn the electric power into heat in the form of steam which is used to a very great extent in many industries, especially in the pulp and paper industry. To do this, of course, other factors have to be favourable such as the transmission of the power, the proper voltage available that would not mean any further transformation and the low cost of the whole installation for generating steam electrically.

Although some of these installations which are in operation today may be considered as quite temporary due to the prevailing exceptional conditions, there is no doubt that in many cases the electric steam generator is going to stay and be used at such times as there is power available from the power companies. This is usually the case during three or four summer months when the waterflow in the river is high and a certain amount of surplus power is available. It may even be feasible to use only night power by close co-operation of the power company with the power user ,and the fact that starting and stopping electric steam generators takes only a few minutes. These are all points which make the steam generator a very flexible apparatus and make it very useful to convert electric energy at any time at short notice and at extremely low cost to valuable heat energy.

Efficiency

In the electric steam generator all electric energy is converted into heat energy, the electric current passes through a resistance either of metal or formed by the water to be evaporated. The whole process of conversion is therefore governed by ohmic law. 1 K.W.H. is equivalent to 3412 b.t.u., the total heat content of 1 lb. of steam at an absolute pressure of 150 lbs. per square

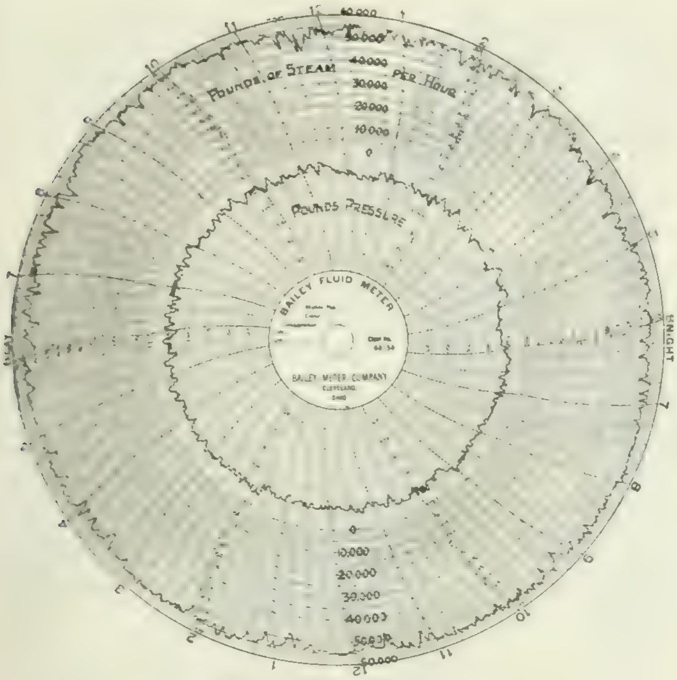


Fig. No. 1 Record of Performance

inch is 1193 b.t.u. Assuming feed water temperature of 150° F. the total heat to be supplied will be 1193 — (150-32) = 1075 b.t.u. I.K.W.H. will therefore produce $\frac{3412}{1075}$ = 3.17 lbs. of steam, no heat loss considered.

The efficiency of the electric steam generator is very high, the only losses are the radiation losses of the appatus, and the heat losses represented by a certain amount of water discharged from the generator which carries away a certain amount of accumulated impurities in the feed water. By proper lagging and regulation of this discharge water the losses become very small and depending on the size of the generator may be from 1 to 4% — for larger sizes of generators the efficiency can be taken around 98%. On this basis 1 K.W.H. will produce 3.10 lbs. steam. Under average conditions 1 lb. of soft coal of about 12, 000 b.t.u. evaporates about 8 lbs. of water. 1 ton of 2,000 lbs. of coal evaporates 16,000 lbs. of water. The electric energy required to evaporate the same amount of water is equal to $\frac{16,000}{3.10}$ = 5161 KWH. = 215 KW days = .59 K.W. years = .8 H.P. year, or in other words 215 K.W. in an electric steam generator is equal to one ton of coal per day, burned under average conditions of boiler efficiency.

Comparing the capacity of an electric steam generator with the capacity of a regular boiler in boiler horsepower, we find the following relations: One boiler horsepower is defined equivalent as the evaporation of 34½ lbs. of water from and at 212° F. per hour and représents 33,479 b.t.u. per hour, 1 K.W. hour being 3412 b.t.u. and at an average efficiency of 98% equal to 3342. These figures are almost exactly in the ratio of 10 to 1, therefore, an electric steam generator of 1000 K.W. capacity is equal to a boiler of 100 boiler horsepower.

Classes of Electric Steam Generators

Electric steam generators have been built during the last ten years in capacities up to 1,000 K.W., and only in the last two years sizes of 2,000 K.W. and more have made their appearance. Steam generators may be divided into two main and distinct classes:

First — Generators in which the electric current passes through a combination of metallic resistors.

Second — Generators in which the water itself forms the electric resistance.

Metallic Resistance

In the first case the metallic resistors in the form of wire and ribbon of some high resistance allow may be mounted in tubes similar to those in fire tube boilers. The arrangements allows the use of alternating or direct current as heating elements do not come in direct contact with water. In all other cases where the resistors are in contact with water and the current passes partly through metallic resistors and partly through water only alternating current can be used as direct current would decompose water into its elements hydrogen and oxygen. Generators of the metallic resistor type are only suitable for low voltages up to about 500 volts and are therefore not usually adaptable for very large outputs. The steam production is controlled by swtiching on and off of a number of parallel circuits and the combination of such circuits in parallel or series connection. To maintain a constant steam pressure requires, therefore, rather complicated and expensive electric control equipment. Generators of this type have been built of 1500 K.W. capacity, being of the tubular type construction, about 20 ft. long and 5ft. 6 inches in diameter. The space occupied by this type of generator is comparatively large compared with the steam generating capacity.

Water Resistance Type

The second class of generators which will be mainly dealt with in this paper are built on a principle quite different from the metallic resistor units. The electric current passes through steam tight insulating bushings to a system of stationary electrodes partly submerged in water, the water to be evaporated serves as the electric resistance. This type of generator is known as the "Revel Generator" and has been in use principally in Italy, Switzerland and France for the last ten years, mostly in self-contained units up to about 700 K.W. For any considerable amount of electric power only a three phase alternating current system may be considered as practical today. For small units and of voltages up to about 2,200 volts, the container itself forms the neutral point of the three phase system and is grounded. For larger capacity generators, especially when the voltage is in excess of 2,200 volts up to 12,000 volts, it will be advisable to split up the generator into three single phase units with three containers, each containing one electrode, the three containers form again the neutral point and are metallically connected together and grounded. Owing to the comparatively high resistance of the water and the many possibilities of arranging the electrodes, it is possible to make use of comparatively high voltages such as are used in general distribution of power in industrial plants,

and the use of step-down transformers, the cost of which would be greater than the cost of the steam generator itself is obviated. In order to maintain a constant steam pressure the generation of the steam has to follow closely the demand of the steam which means the electric power input has to be regulated to suit the steam demand. This is done by the variation of the electric resistance, either by changing the submersion of the electrodes, or varying the specific resistance of the water by suitably adjusting the amount of water fed to the generator and by controlling the water discharged either continuously or at certain intervals, carrying with it the accumulated impurities in the water.

The outstanding advantages of the steam generator of the water resistance type compared with other types are its simplicity in construction, compactness, easy control, and its very low cost per kilowatt capacity which is very often the determining factor, especially for temporary installations or where flat rate power is consumed to fatten the load factor of an industrial plant.

Construction Details of Water Resistance Type of Generator

The balance of this paper will deal only with generators of the water-resistance type. For a long time water has been used as a resistor of alternating current in various apparatus, mainly as energy absorber for electric generators under test and in starting devices for alternating current motors. In the latter case a salt is added to the water as otherwise the resistance would be too high. The use of water itself as an electric resistor for the production of steam is quite obvious though it requires a certain amount of investigation as to the suitability of different sources of water, the variations of the resistance of water at various temperatures and pressure and the practical limits in dimensioning the current path through water for various amounts of energy and voltages up to 12,000 volts. The resistance of chemically pure water is very high and of the order of an insulator, the resistance decreases with the contents of soluble salts — it is lower for spring water than river water. Condensate water, available in most cases where the electric steam generator is in use, is of a high resistance, but as it contains always from 20 percent to 40 percent make-up water drawn from the river or other sources its conductivity is brought up again to quite a practical figure. In general, it can be said, that any water satisfactory for ordinary boilers is also suitable for the electric steam generator. The resistance of water has a negative temperature coefficient; that is, the resistance is decreasing as the temperature and the pressure rise. Considerable investigations and tests have been made by the writer to determine the relations of resistance and temperature for various kinds of water, and special apparatus has been built for this purpose for currents up to 10 amperes and 6,000 volts for tests under atmospheric pressure. Fig. 1, shows a set of curves giving the relation of temperature and resistance for raw water from the St.Maurice River and for condensate water with about 25% raw water from the same source. Using a logarithmic scale the curves appear as straight lines and for many other tests not shown on this diagram it was found that these lines were all very nearly parallel. This would indicate that the same general law applies to any kind of water. The curves have been verified above 100° C. temperature by tests on steam generators under pressure. The curve as shown on diagram, Fig. 2, can be expressed mathematically as follows:

$$R = \frac{C}{\sqrt[5]{T^4}}$$

R = Ohms per cubic inch

C a constant, 42,000 for curve A, 87,000 for curve B temperature of water in centigrade.

In the early stages of the development of the steam generator it was thought that the investigation of the relation of temperature and resistance of different kinds of water would be of great importance but it has been found later by experience in the operation of the steam generator that the resistance of the water in the steam generator could be controlled over a considerable range by discharging a certain amount of water from the generator. The purer the water and the higher the resistance the less water is to be discharged in order to maintain a suitable conductivity of the water.

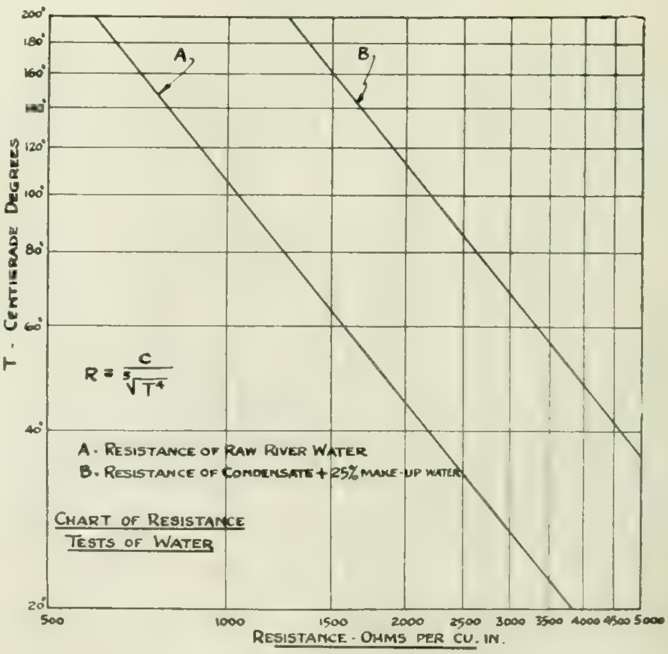


Fig. 2

Fig. 3 shows a section of a 5,000 K.W. generator, it consists of a vertical cylindrical tank with an extension at the bottom. The upper part is flanged and to it is bolted a dished cover which contains three openings for the porcelain bushings insulating the three copper conductors leading to the electrodes. The insulator bushing consists of three parts, two corrugated sleeves, one of which is outside and the other inside the tank and a tube inside these sleeves which are held together by a shoulder and nut of the conductor passing through them. The faces of the sleeves are ground and are parallel and are made steam tight with the usual rubber steam packing.

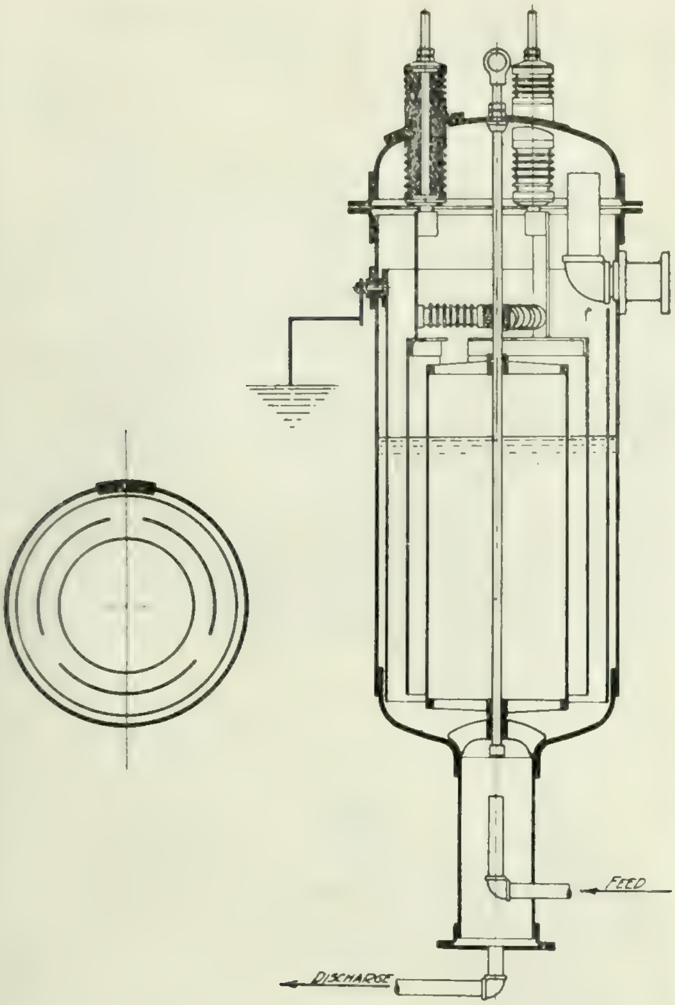


Fig. No. 3 Electric Steam Generator.—Three-Phase-Single Unit System.

The packing also allows a certain adjustment for the difference in the expansion of porcelain and copper. The porcelain sleeves are subjected to considerable pressure and are made rather heavy for mechanical reasons and with electrical characteristics suitable for at least 6,600 volts working pressure between the phases. The conductors support through a system of adjustable links the steel electrodes of curved plates arranged in a circle equidistant from two cylinders, one outside and one inside, forming the neutral point of the 3 phase system, the outside fastened to the generator shell proper and the inside suspended from the cover and well secured in a central position. Both these cylinders are electrically connected to the body of the generator and grounded. The arrangement shown in Fig. 3 is for 1,300 amperes, 2,200 volts, 3 phase, 60 cycles and for a working pressure of 165 lbs. per square inch. The electric current passes through from both sides of the electrode to the inside and outside cylinders, and to a much smaller amount directly from electrode to electrode.

Fig's. 4 and 5 show pictures of two sizes of 3 phase, one tank steam generators of the water resistance type both for 2,200 volt, the small one of 1,500 K.W., and the larger one for 5,000 K.W. capacity, both are of the same general design.

Calculation of Ohmic Resistance

As the path of the electric current is not sharply defined the ohmic resistance can only be calculated approximately.

Let R be the ohmic resistance between electrode and ground

- A = Total area of submerged part of electrode in sq. in.
- d = Distance between electrode and ground in inches.
- s = Resistance in ohms per cubic inch of water at normal operation of generator.
- E = Voltage to neutral
- I = Current in amperes
- P = Electric power in K.W.
- a = Current density $= \frac{I}{A}$ (1)

We have then $R = \frac{d}{A} \quad s = \frac{E}{I}$ (1)

$$A = \frac{I}{a} \quad (2)$$

Substituting in equation No. 1 we get

$$E = d.a.s. \quad (3)$$

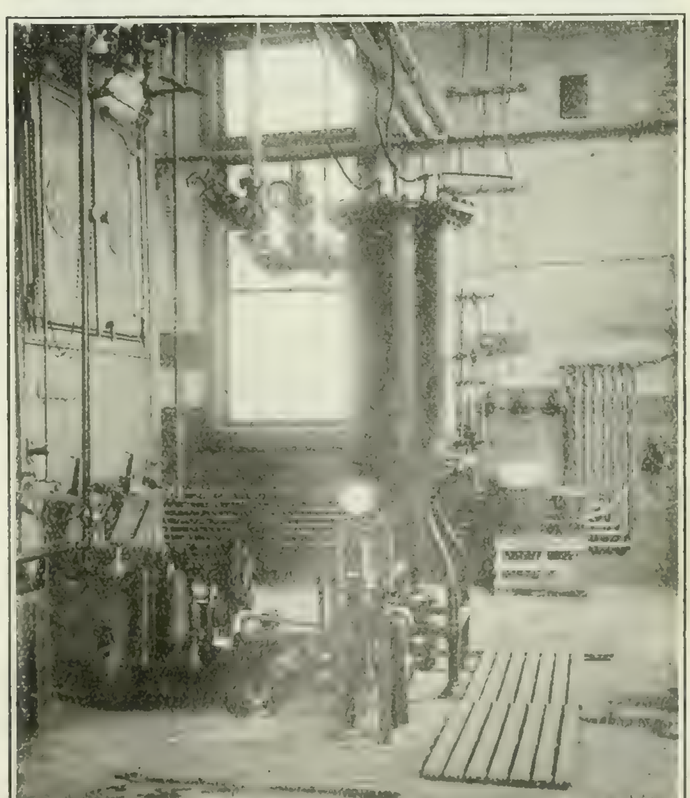


Fig. 4. 1500 K.W. Steam generator, 2200 volts, 3 phase, 100 lbs. pressure.

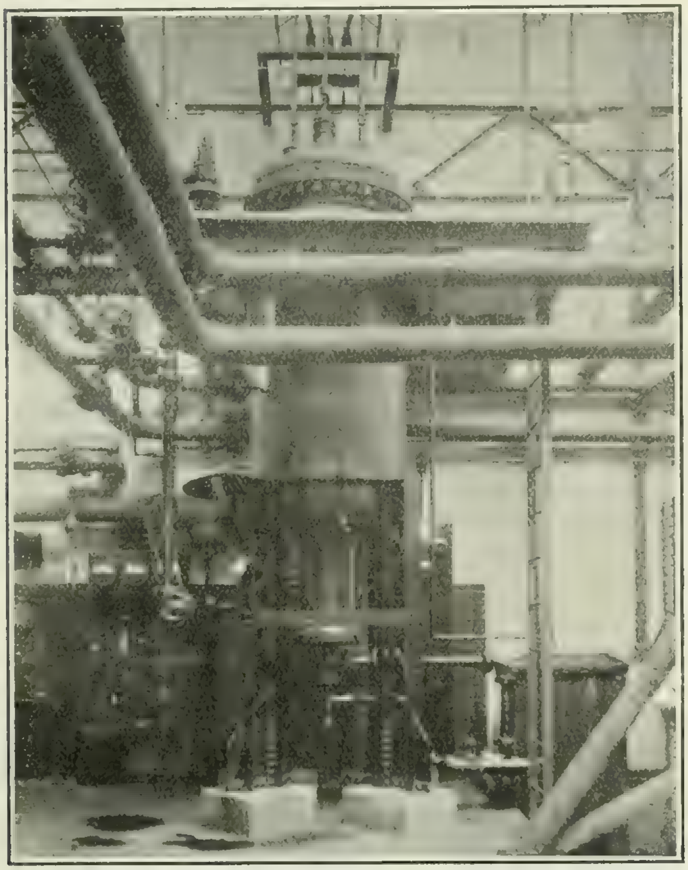


Fig. No. 5 5000 KW Steam Generator, 22000 volts, 3 phase, 165 lbs. pressure.

In equation No. 3 the right side contains three variables, the choosing of which is mainly a matter of experience and compromise to secure a satisfactory mechanical arrangement and safe operation. After d and a are chosen s is fixed—that means for a certain load and water level the specific resistance of the water has to be maintained by adjusting the relative amounts of inflowing and outflowing water. The outside shell of this 5,000 K.W' generator is 42″ (107 cm.) diam. The length of the cylinder part is about 70″ and is designed to stand a test pressure of 350 lbs. per sq. in. The lower end is provided with an inlet for the feed water and an outlet for the discharge and blow-off water. The generator is equipped with the customary water and pressure gauges and safety valves and the tank is mounted on a steel frame; for the larger generators is provided a gallery to give access to the top of the apparatus.

Fig. 6 shows an arrangement of the three tanks forming one steam generator unit, each tank containing one cylindrical electrode connected to one phase on the three phase system. The tanks are connected on the steam side to a steam header, each tank having its separate inlet and bleeder for feed water. The three tank arrangement affords a very simple mechanical design and permits a more accurate calculation of the ohmic resistance of one phase to ground. The resistance of a body of water between two concentric cylinders may be integrated and expressed as follows:

$$R = \frac{s}{2\pi h} \log c \frac{r_1}{r_2} = \frac{E}{1}$$

Where h means the height of the cylinder
r_1 means the radius of outside cylinder
r_2 means the radius of the inside cylinder

From this equation the dimensions of this type of generator may be determined in a similar way as above for the three electrode arrangement in one tank.

In Fig. 7 is shown an installation of such a three tank unit, the general dimensions of the single tank are the same as above for the 5,000 K.W. single tank unit. The voltage is 6.600 volts, the normal power input 18,000 K.W. with a maximum of 22,000 K.W., and at a working pressure of 135 lbs. — Up to 60,000 lbs. of steam per hour are produced. The higher the steam production from a certain area of water surface, the wetter the steam produced. In the above shown installation a 10 inch standard steam separator keeps the moisture content of the steam down to 1½%. Two similar generators of 25,000 K.W. each, and one of 12,000 K.W. are at present in course of construction.

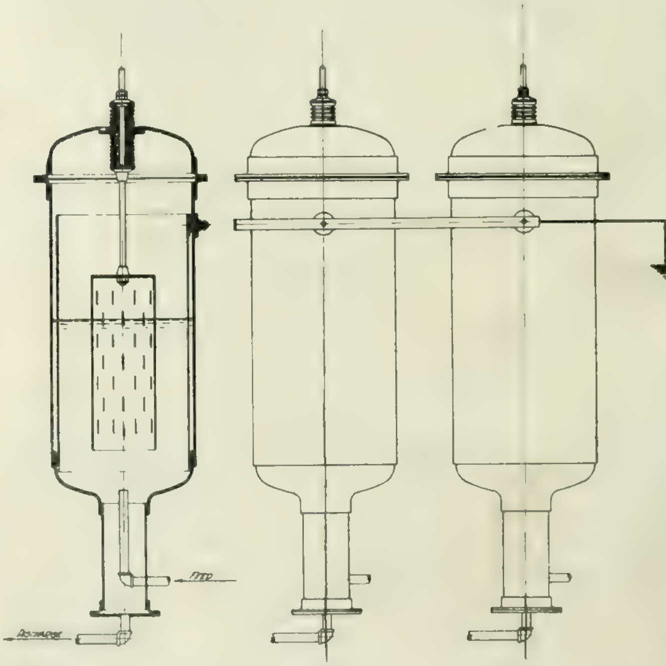


Fig. No. 6 Electric Steam Generator, Three Phase, Three Unit System.

Floor Space and Operating Details

The floor space required by these types of generators is very small, the 5,000 K.W. generator with electric control apparatus can easily be placed in an area of 10 x 12 ft., and the 18,000 K.W. generator, equal to 1,800 boiler H.P., with all its accessories will need a floor space of about 15 x 22 ft., and a head-room for easily dismantling of 25 ft.

The operation is extremely simple for the small generator and where they are not working in parallel with other steam plants, the operation can be made automatic by means of a regulating valve actuated by the pressure and controlling the amount of discharge water, thereby changing the water level, which, in turn, governs the power input and steam production and at the same time keeps the steam pressure constant. For large units and especially where they form only a smaller part of the existing steam plant and are therefore, not able to control the pressure alone, automatic regulation is not so simple, but the attention required is so small that one man could easily handle the operation of two to three very large units. For the electric control of the steam generator the usual apparatus such as disconnecting switches, oil switches, and preferably three ammeters to show the balance in the three phase, is required. Power measuring instruments may be added, depending on the nature of the power contract and supply.

As the heat in the steam generator is produced in the water there are no parts subjected to a higher temperature than the temperature of the steam. This means that no dangerous stresses are produced by temperature differences and this adds further to the safety of the apparatus.

There are other advantages of the electric steam generator over the usual coal fired boiler, for instance any interruptions to feed water supply simply means the shutting down of the generator and does not introduce any danger. The steam generator is equipped with the usual steam safety valves and can in addition be supplied with automatic blow-off valve which discharges the water and thereby shuts down the generator should the pressure go beyond a fixed limit. Other safety devices consist in relay protection of the electric circuit in case of short circuit, unbalancing or ground on the electric system, and a trip for the automatic oil switch, which will interrupt power and therefore the steam supply. It can be seen therefore that the operation of the steam generator is just as safe as, if not safer than the ordinary boiler and the insurance companies have no hesitation in accepting insurance on this apparatus in the usual manner.

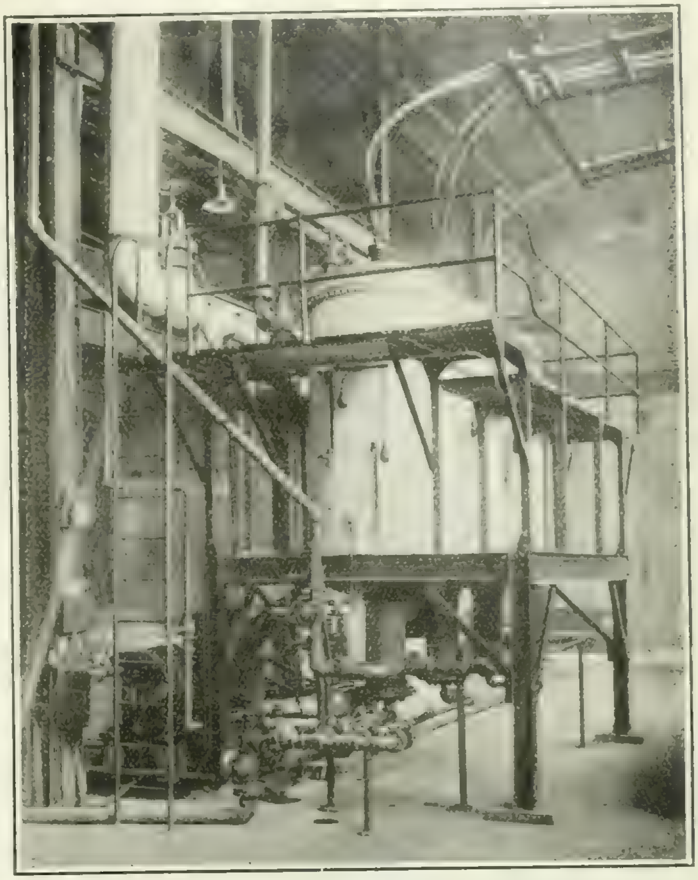


Fig. No. 7 18,000 KW Steam Generator. 6600 volts, 3 phase, 130 lbs. pressure.

Conclusions

1. The generator of the water resistance type is safe and easil controllyed.

2. The apparatus can be installed in a very small space close to where the steam is required. Its design and operation are very simple and only needs the attention of an ordinary skilled man.

3. The generator is the cheapest electric method of converting electric energy into heat.

4. For the consumer of power the generator means the utilization of any idle power and thereby the improvement of the load factor.

5. The power company is able to sell its surplus power for the generation of steam which is made possible mainly by the fact that the first cost and installation of the steam generator is comparatively low.

6. By the introduction of such a simple and cheap device much idle electric power can be utilized, which in itself means a further step in the conservation of our natural resources.

The New 41,000 H.P. Unit at Shawinigan Falls

Julian C. Smith, M.E.I.C.

Description of some of the design features of the latest hydro electric development of the Shawinigan Water and Power Company.

Paper presented at the Professional Meeting, Montreal, January 25th, 1922.

In presenting a description of the latest hydro electric development at Shawinigan Falls it is the writer's intention merely to describe briefly those features of design and construction, which because of their departure from more usual practice, are worthy of attention.

Rating of Waterwheel

The rated capacity of the waterwheel of the new unit is 41,000 H.P. and the wheel will operate at 138.5 R.P.M. under a head of 145 ft. The art of manufacturing waterwheels has advanced rapidly during the last twenty years. The first wheels installed at Shawinigan in 1903 were rated at 6,000 H.P. at 180 R.P.M., and were the largest wheels that could be built at that time. By the time of the second development at Shawinigan in 1910 it was possible to install horizontal double runner turbines with a rating of 18,500 H.P. In 1922 there are wheels in operation of 52,000 H.P., and the Hydro Electric Commission of Ontario are considering for their Queenston installation waterwheels having an even greater capacity.

Water-Flow

In order to provide the water for the unit at Shawinigan, about 3,000 cu. ft. per second additional flow is required. The existing canal through which the water flows to the head-gates is 130 ft. wide by 35 ft. deep. It is restricted to this width at the upper end by the bridge which carries the railroad spur and roadway giving access to the power house. Owing to the fact that the velocity of the water in the canal will be increased only about 25%, or to 3¼ ft. per second, which is not excessive, it was decided that the expense of widening the canal, which would necessitate an additional bridge span, was not warranted. The total flow for the full capacity of 220,000 H.P. at existing load factor for the two power houses at Shawinigan Falls will be about 12,000 cu. ft. per second.

Fore-Bay Extension

The fore-bay extension begins on the downstream side of the bridge and is carried in a straight line to the end of the bulkhead extension. Excavation in this part of the work has been begun and will be carried in the dry as closely as possible to the existing crib. After the bulkhead and the new crib are completed and as much of the rock taken out as possible, the extension will be flooded and the old crib and remaining rock will be removed by dredging.

Gatehouse

The extension to the gatehouse is very similar in detail to the existing building. It is 80 ft. long and contains five sluiceways, each 12 ft. wide, the same width as the sluiceways in the existing building, thus enabling the same stop logs and similar gates and racks to be used. It is not intended to instal gates at present as it is hoped to regulate the flow by the Larner Johnson valve. However, grooves will be left in the concrete so that gates can be installed later if necessary.

Heating System for Prevention of Ice Formation

One of the features of the 1910 development at Shawinigan Falls was the provision for prevention of the forming of ice on the racks. In the early days of the power development at Shawinigan the operation of the gates and the clearing of the racks were made very difficult in winter owing to the formation of ice on all iron parts in contact with the water. It was believed that the formation of this ice was due to the fact that the iron, being slightly colder than the water, conducted heat away from the water thus causing the formation of ice on the iron. In order to raise the temperature of the iron slightly, large air ducts are provided in the gatehouse floor extending the entire length with laterals across the building into the chambers leading to the penstocks so that air can be discharged into these chambers and blown down against the racks. This heating system is being extended to serve the addition to the gatehouse as it has been found that the system is very efficient. A fan with a capacity of 60,000 cu. ft., of free air per minute is located at the far end of the building. The air is drawn into the fan through electric heaters and discharged at a temperature of 150° F. into the main duct. Since the installation of this system there has been no ice formation inside the building and no tendency of the ice in the water to stick to the rack bars. Further, the ice has not formed around the gates and consequently no difficulty has been experienced in operating the head-gates in the most severe weather.

Gathering Tube

A very interesting feature of the development is the tunnel intake designed by Messrs. R. D. Johnson and P. Wahlman of New York. It consists of five parallel water passages, one from each of the sluiceways in the bulkhead, which empty into a manifold, or gathering tube. The water passages are nearly rectangular in section and meet the gathering tube at an angle of about 35°. The upstream water passage is joined to the gathering tube at the control section by means of an elbow, the other passages join the gathering tube in long narrow slots. The gathering tube itself is circular in section, 20 ft. in diameter at the downstream and where it meets the tunnel and tapering to 13′ 4″ in diameter at the upstream end or control section.

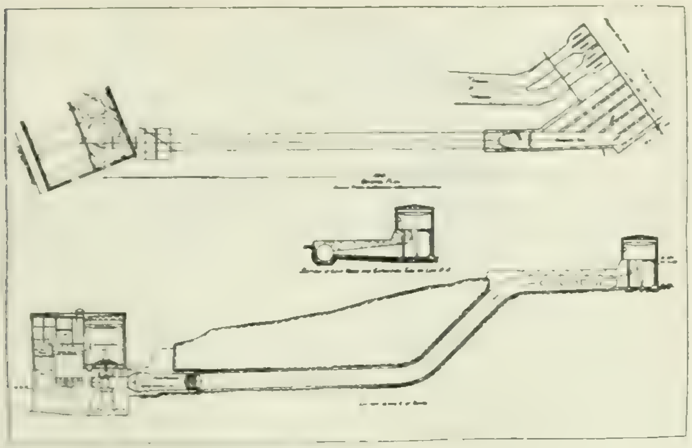


Figure 1

Plan of Extension to No. 2 Development at Shawinigan Falls

The function of the intake is to cause a uniform flow of water in each of the five sluiceways and to discharge the water into the tunnel with a minimum of disturbance. The hydraulic theory of its operation is roughly as follows:

In order to fulfill the hypothesis on which the design is based, the flow from the water passages into the gathering tube must be uniform per unit of length.

The diameter of the gathering tube at any section was fixed by making the quantity of water flowing at that section proportional to the square of the velocity, that is at any point in the gathering tube Q/V^2 is a constant. This relationship was decided on after some study, as giving the most economical dimensions for the gathering tube.

At any point beyond the control section in the gathering tube the water arrives from two sources, a small part of it from a section of the slot adjacent to the point considered and a large part from the gathering tube itself. The difference between the loss of head which has accumulated in the gathering tube up to this point and the loss which has accumulated in the water passage must be just large enough to cause the required quantity of water to flow through the slot.

When losses up to the point under consideration have been determined the depth of slot at that point can be calculated.

The friction loss was based on a coefficient of 130 in the Hazen and Williams' formula, which is equivalent to about N = 0.12 in Kutters' formula and the coefficient of discharge for the slots was taken as 0.98.

The total loss of head in the intake has been estimated to be 4¾″ for a discharge of 2,940 sec. ft. This loss may seem rather large at first sight, but the complication of the design necessary to effect a material reduction did not appear to be warranted by the gain in energy, and the assurance of getting even distribution of flow would be reduced. It was thought proper, therefore, to sacrifice a little head to insure nearly uniform distribution of flow through the racks in the belief that the total loss will be less than would ordinarily be the case with high local velocities through them.

It is interesting to note that the uniformity of distribution is not to any material extent, within reasonable limits, a function of the quantity of water drawn through the intake so that, with the dimensions determined for the maximum draft, the distribution will remain practically uniform for other quantities drawn.

A little study of the problems involved in the design will indicate that the forces dealt with are very small and yet their relation to each other is the only consideration upon which reliance can be placed to secure the desired distribution of flow. A slight variation of the dimensions determined may cause a noticeable unbalance of distribution. This was well shown in a model which was constructed for us by the I.P. Morris Co., and tested in their laboratory. At the first run it was found that the flow was unbalanced, especially between the first, or upstream, and second sluiceways. The model was emptied and the dimensions checked up and it was discovered that the throat of the control section was a little too large. This was corrected by placing fillets 1/8″ thick top and bottom in the throat and the model was again tested with the result that a uniform flow was obtained in all five sluiceways. The scale of the model was 1/15 full size so that these 1/8″ fillets would correspond to a little less than 2″ in the full sized tube.

Tunnel

The water passes from the gathering tube into a tunnel, 20 ft. in diameter, which delivers it to the steel penstock at the bottom. The tunnel was chosen in preference to a steel penstock for economy both in construction and in upkeep. The completed portion of the tunnel has cost less than $370.00 per foot, whereas the steel penstock, which connects the tunnel to the Larner Johnson valve, will cost erected about $450.00 per foot.

The tunnel is lined with concrete averaging about 2 ft., in thickness, which is reinforced throughout its length. The reinforcement for some distance from each end was designed to take care of the static head plus the surge. The allowance for surge at the lower end amounts to a little more than the static head, the combined pressure being 126 lbs. per square inch. In other words, the tunnel at the bottom is reinforced to take care of a bursting pressure of 3,600,000 lbs. per foot. This reinforcement consists of hoops of 1¼″ diameter bars spaced 3″ on centres at the lower end of the tunnel, 12″ on centres in the central part and 6″ on centres at the upper end. The hoops are tied together longitudinally by ¾″ diameter bars about 2 ft. on centres which act as spacers and as temperature reinforcement.

A section of steel penstock 77 ft. long and 20 ft. in diameter connects the tunnel with the Larner Johnson valve. This penstock is built of 1¼″ plates and is anchored into the tunnel by means of seven rings of 4 x 4 x ¾″ angle, which are rivetted to the plates. These rings will also serve as seals to prevent leakage along the penstock.

The loss of head in the tunnel and penstock using a coefficient of .012 in Kutters' formula will be about .7 of a foot, so that the total loss of head up to the turbine will be about 1.1 ft.

The rock through which the tunnel was driven is a very hard granite, compact throughout the length of the tunnel except at the upper end near the surface where faults were encountered.

The tunnel was driven from the lower end in the usual manner by first driving a heading ten to fifteen feet ahead of the face and then shooting down the roof. Most of the mucking was done by a one yard, motor driven, Thew shovel of a type especially designed for this kind of work. The muck was loaded by the shovel into skips, hauled to the portal and hoisted by derricks either to the crusher platform, or to dump cars which carried it to the spoil bank.

Owing to the hardness of the rock the cost of tunnel excavation was high, averaging $7.22 per cubic yard. The cost of drilling and blasting alone was half of this amount, the balance being made up of handling, loading, hauling to dump and pumping.

After the excavation was completed the invert for the lining was placed, beginning at the upper end and working towards the portal, the bottom being cleaned out and the tracks removed just ahead of this work.

The forms were then erected on the invert and the upper part of the lining concreted, beginning about 30 ft. from the portal and working towards the upper end.

The forms for the straight portions of the tunnel were made of 2″ B.C. fir lagging supported on structural steel ribs spaced 2′6″ on centres. The lagging was delivered to the job in 10 ft. lengths and dressed to a 10 ft. radius like the staves of a tank. The steel ribs were composed of two 6″ x 3½″ angles back to back and were anchored to the rock by means of 1″ bolts so that no internal bracing was required and the whole interior of the tunnel was left clear for the dismantling and carrying ahead of the forms as the work progressed.

The concrete was mixed at the upper end of the tunnel and delivered by means of a chute to a hopper part way down the slope. From the hopper it was fed into a pneumatic mixer which forced it under 200 lbs. pressure through an 8″ pipe into the forms. This method of placing the concrete gave us a very dense lining with a remarkably smooth surface.

The forms for the tunnel elbows were built outside on a platform near the carpenter shop and there lowered into the tunnel in sections about 5 ft. long.

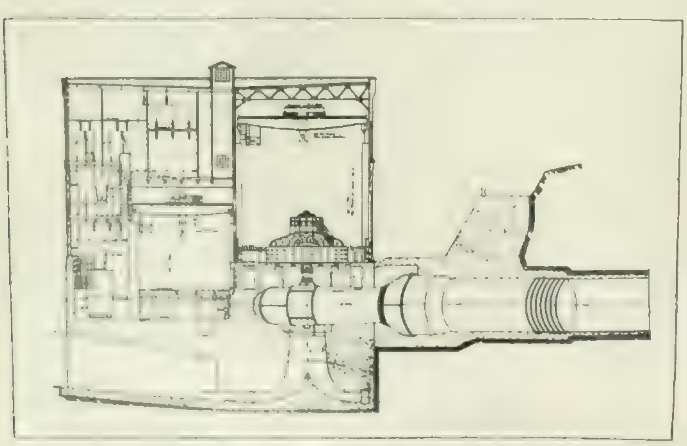


Figure 2
Power-House Cross Section Through Centre line of Unit No. 6

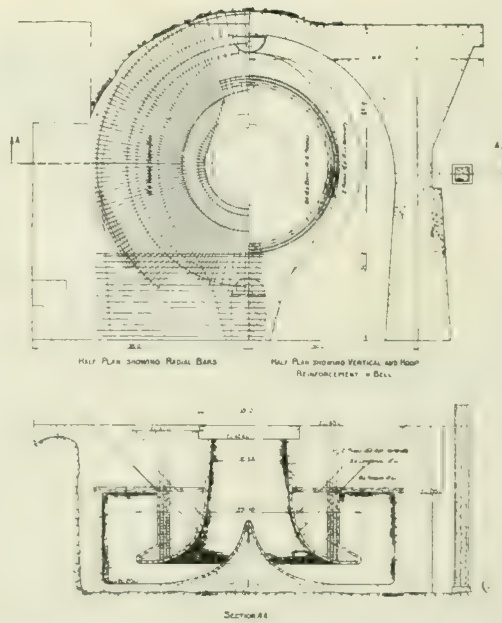


Figure 3
Plan and Section of Draft Tube, showing Reinforcement
Moody Draft Tube.

Power House

In designing the Power House superstructure the details of the existing building were followed as closely as possible and the only marked differences are in the elevation of the operating floor and in the height of the new generator room.

The extension is 80 ft. long and the same width and height as the old building, that is, 115 ft. wide by 75 ft. high.

The new unit occupies the upstream part of the extension, the generator room being 50 ft. wide by 80 ft. long and the full height of the building. It is served by a crane, the trolley of which is designed to lift 200 tons and the bridge for a load of 150 tons at either end or 200 tons at the centre.

The operating floor of the new unit is 16 ft. above the operating floor in the old part of the building.

The downstream part of the extension will be served by the 100 ton crane that serves the old generator room.

The Moody draft tube in the substructure of the extension presented a number of difficulties both in design and in construction. The principal difficulty in design was in connection with its reinforcement.

The draft tube block can be described as a flat plate with a circular hole in the middle, the bell of the drafe tube being suspended from the bottom of the plate. The walls supporting the plate are roughly in the shape of a horseshoe, 52 ft. in diameter and 48 ft. between the points. The plate is 12 ft. thick. The total load, including the weight of the block, is something over 12,000,000 lbs. The problem was to reinforce this block in such a way that it could be poured in sections not exceeding 250 cu. yds. which was about a day's run for the mixer.

The most obvious method of reinforcing it was to run bars in two directions at right angles to each other as in an ordinary flat plate. This method, however, was found to be impracticable on account of the fact that there would have been required four layers of 1¼″ bars on 6″ centres each way which would have meant a total of eight layers where the bars crossed, or a net work of bars 4′ deep like a stack of 6″ mesh sieves. It does not require a very vivid imagination to picture the kind of concrete that would have been obtained at the bottom of that mass of steel.

The method used was, therefore, decided upon as most nearly complying with all of the requirements. It consists of hoops and vertical bars placed near the outside of the bell, horizontal bars placed radially at the bottom of the plate and diagonal bars to take care of the shear or web stresses. The part of the block between the points of the horseshoe was reinforced as a beam in order to provide support for the plate on that side.

In this system the bars are in comparatively short lengths and easy to handle. There are at most two layers of bars vertically and they do not cross to form a grid and construction joints can be formed on practically any radial line as there is no shear on the radial planes.

The stresses were limited to 12,000 lbs. per square inch tension in the steel, 500 lbs. per square inch compression in the concrete, and 50 lbs. per square inch bond stress.

In designing and constructing the form work a great deal of care was taken to prevent deflection of the forms and to ensure smooth surfaces for the water passages. The construction of the draft tube bell particularly was a very intricate piece of work and required the services of several pattern makers. The ribs for the bell were all cut and shaped in the shop and the whole assembled before being set in place. We have been amply repaid for the care taken in this regard by the smoothness of the finished surfaces and the resulting accuracy of line and grade which will make the assembling of the machinery merely a matter of setting in place.

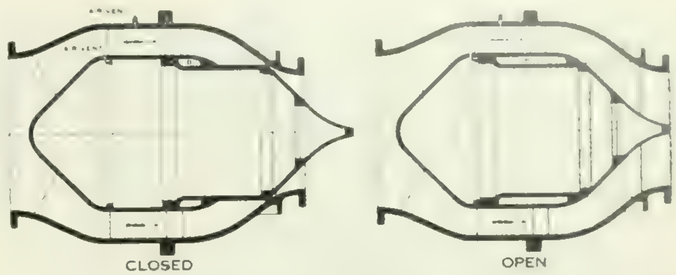
Larner-Johnson Valve

The Larner-Johnson valve which is being manufactured for this development at the Dominion Engineering Works is the largest valve that has ever been built. It is about 23 ft. in diameter and 27 ft. long and weighs approximately 150 tons. The moving part of the valve alone weighs 25 tons.

The valve will be located in a chamber outside of the Power House between the 20 ft. diameter penstock and the turbine casing. It can be operated either in the valve chamber or by means of a three way valve at the generator control board.

The valve consists of a bell-shaped, cast steel shell, 22′-6″ inside diameter tapering to 13 ft. diameter at the outlet, a cylinder inside the shell 16 ft. in diameter which is rigidly attached to the shell and has a conical head pointing upstream and a plunger which slides in the cylinder. The plunger terminates in a conical nose.

Between the cylinder and the plunger there is an annular chamber, sealed at one end by a ring attached to the plunger and at the other end by a ring attached



Type A Larner-Johnson Valve

to the cylinder. These rings are lined with brass and serve as guide bearings for the plunger.

The valve is hydraulically operated by a differential pressure on the two sides of the plunger. When the valve is open and balanced, the cylinder and the annular space between cylinder and plunger are under the full penstock pressure and of course the penstock pressure is exerted on the nose of the plunger. To close the valve the penstock pressure is maintained in the cylinder and the pressure in the annular chamber is released. This causes the plunger to move forward and closes the valve in a manner similar to the action of a needle valve. An automatic damping device slows down the motion of the plunger as it nears the valve seat.

To open the valve the operation is reversed. Water is admitted to the annular chamber under penstock pressure and the pressure in the cylinder is released.

The pressure in the cylinder and in the annular chamber is controlled by means of three 12″ Larner-Johnson valves so arranged and connected that the large valve can be balanced in any position from closed to full open.

Figure 5
Cast Iron Plunger of 20 ft. Larner-Johnson Valve, weight 46.000 lbs.

Selection of Type of Unit

The remainder of this paper will deal with the electrical features of the installation.

When the second hydro electric development was made in Shawinigan in 1910, the horizontal type of unit was adopted and the 18,500 H.P. double runner turbines then installed were among the largest machines to be built at that time. It was then assumed that the ultimate development at this plant would be carried out with this type of machine. When, however, the demands for additional power necessitated an extension of the plant in 1920 and a careful study was made of the more recent development of turbine manufacture it was decided to adopt the vertical type of unit as being the most economical machine to produce the required power.

It is not necessary here to compare at length the relative merits of vertical and horizontal units. In adopting the vertical type of machine for this installation consideration was given to economy of space and material. The centre to centre spacing of the three 41,000 H.P. machines, which will be the ultimate development at Shawinigan is 60 feet. The centre to centre spacing of the present 18,500 H.P. units is 40 feet, so that there is a decided saving of space with the new vertical units. The dimensions of the vertical machines are such that an extension of the present power house on the same dimensions affords ample room. In fact, were it not for the necessity of extending the present crane runway the downstream side of the power house could be narrowed considerably in the extension.

The problem of bearings for vertical units has been successfuly solved by more than one manufacturer and this objection to the vertical type of construction no longer exists. The advantages of weight and low mechanical stresses are on the side of vertical machines so that the change from horizontal to vertical units in this power house is amply justified.

Rating of Unit and Characteristics

The rating of the generator is 30,000 K.W. at 75% power factor which is equivalent to 40,000 K.V.A. The power will be generated at 11,000 volts, 3 phase, 60 cycles and the machine will operate at 138.5 rev. per minute, being designed with 52 poles.

The short circuit characteristics of the machine are such that the instantaneous short circuit current will be 3.3 times full load current and the sustained short circuit current at normal excitation will be equal to twice full load current. It is interesting to note that with the high internal reactance necessary to give these results the short circuit current on light load and correspondingly light excitation will not exceed one-half full load current.

The stator coils are form wound and the mica insulation is put on in the form of tape. The coils under test have withstood a break-down voltage test up to 59,000 volts on the average.

The full load regulation of the machine at 100% power factor will be 15% and at 90% power factor 28%.

Mechanical Features

The rotor is of cast steel and is built to withstand the stresses which would be developed at double normal speed, that is at a peripheral velocity of 21,800 ft per minute.

To facilitate handling, the rotor is constructed in six parts, that is there are three horizontal sections which are split vertically along the axis of the shaft. When the rotor is erected the two halves will be assembled on the shaft and then drawn together with 36 bolts which will be shrunk in place. Each pole piece weighs about one

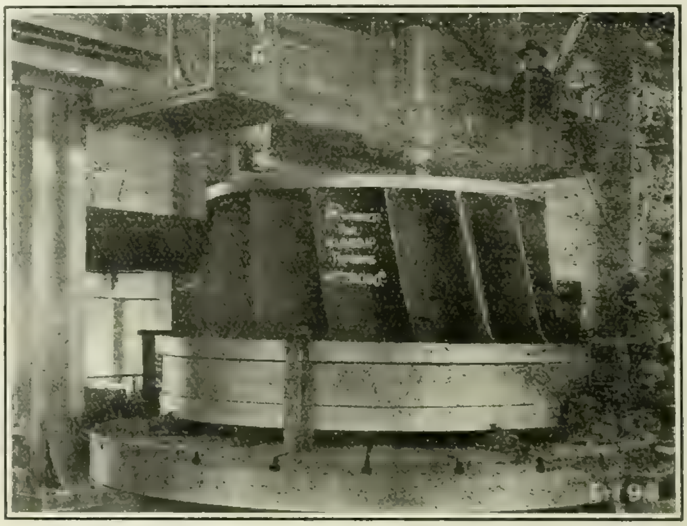


Figure 6
Runner of 41.000 H. P. Turbine being Machined by 18 ft. Niles Bement Pond. Vertical Boring Mill.

ton and is dovetailed into the rotor and secured by wedges and a retaining ring at top and bottom as is usual in this type of construction. In order to reduce windage, the spokes of the rotor are encased with steel plates. The generator rotor and turbine runner are mounted on separate shafts and coupled together on account of the enormous weights of these parts.

Thrust Bearing

The main bearing is of the General Electric spring thrust type consisting of a lower disc with a polished steel surface, split into sectors and supported on a great number of small helical springs on which rubs an upper solid babbitted disc. This construction of the lower disc insures a practically uniform distribution of the weight over the surface of the bearing. The oil flows from an elevated tank up along the shaft and is drawn through the bearing by the centrifugal action of the rotating disc. The lubricating oil is cooled by a water coil which keeps the temperature of the oil below 55° C. and enables the bearing to operate with the exceedingly small oil circulation of about 4 gals. per minute. The bearing is required to carry the weight of the rotor, the turbine runner and the hydraulic thrust which in this unit amount to about 723,000 lbs.

Brakes

In order to bring the machine to rest in a short time when desired, a combination of air and oil actuated brakes is provided which operate on the underside of the rotor. The air pressure required for these brakes is 100

lbs. per sq. in. and a separate oil pressure pump is provided so that the brakes can be used as lifting jacks to raise the rotor.

Structural Features

The structural features of the unit have been so arranged that the operating floor is level with the top of the generator frame instead of with the base as is customary. This arrangement has several advantages as it not only tends to lessen the windage noises but permits the control of the warm air discharged from the generator. The cooling air which amounts to 100,000 cu. ft. per minute is drawn from the wheel pit through radial tunnels and may be discharged from the generator outside the building in the summer, or into the operating room in the winter when the warmth is desirable.

Location of Control Apparatus

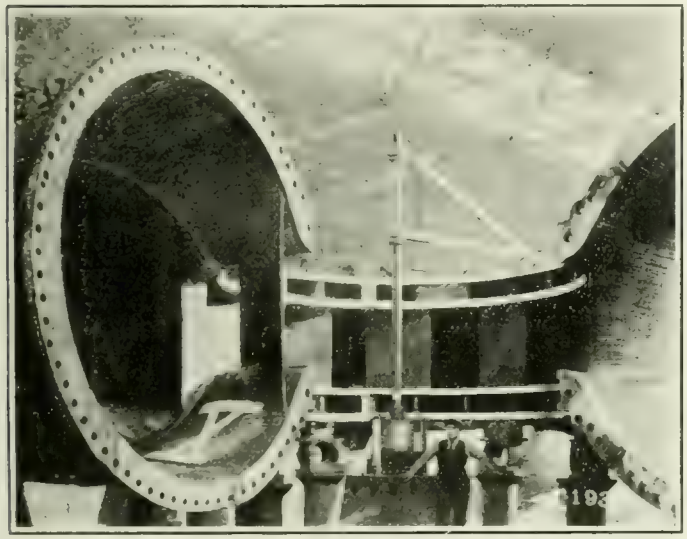


Figure 7
Partial Assembly, of Cast Steel Scroll Casing, 41.000 H. P. Unit, Showing guide Vanes and Lower Distributor Ring

The control apparatus for the generator and turbine will be located on the generator room floor. It is worth noting that in modern station design there is a tendency to place the control apparatus on the operating floor. This reversion to the arrangement followed in the original hydro electric stations is made possible by the design of enclosed and quiet running machines.

Electrical Connections

The keynote of the electrical connections has been simplicity. Each generator will be connected directly to the low tension side of its transformer bank without any intermediary oil circuit breakers which virtually makes each generator and its transformer bank one unit. The 11,000 volt cables from the generators to the transformers are carried in fibre conduits. There are nine single phase cables per unit arranged with the three cables of each phase in a vertical plane. This arrangement gives the best current distribution among the conductors so that although owing to the different reactance of the conductors in different positions, the reactance drop is not the same in all cables, yet the difference is not great enough to cause overheating of any one conductor.

Disconnecting switches are provided in the 11,000 volt cables to facilitate the making of tests.

The will be two 110,000 volt circuit breakers connecting the transformers to the high tension bus as it was considered inadvisable to depend on one switch for so large an amount of power. These breakers are each to be placed in a separate chamber which can be completely shut off so that the effect of a possible fire or explosion may be localised. Provision will be made to ventilate the switchrooms by small electric driven exhausters so as to prevent the accumulation of inflammable gas from the vaporising of the switch oil.

Conclusion

In a brief paper it is not possible to mention all parts of the installation and no attempt has been made to make this description complete as it is intended merely to touch upon the more interesting features of the development.

Rise and Fall in Prices.

A study of price movements during the past hundred years with particular reference to effect of supply of goods and gold.

H. A. Goldman, C.E., A.M.E.I.C.

Advance proof of paper to be read before the Toronto Branch, The Engineering Institute of Canada March 2nd. 1922

Outside of the Great War, there was probably no other subject which has created so much interest, and aroused so much concern in recent years, as the subject of rising commodity prices and the high cost of living.

It is not merely because of its academic importance that the subject has gained such wide spread attention, but because the question of prices is one that so vitally and directly affects the well being of practically every human being throughout the civilized world, and when prices are carried to great extremes, considerable hardship to many people must necessarily follow.

To the engineer the question of prices must be particularly interesting, in the first place, because as a consumer of commodities himself, and as a member of the community he is naturally concerned in any problems affecting the general welfare of the public, and secondly, because engineering is a profession that is closely allied with economics. Not only do engineers have to deal with prices of construction materials in the actual carrying out of their work, but the very adoption or rejection of certain engineering projects may depend entirely on the element of cost. Furthermore, the primary objects of many engineering projects are purely economic ones. The development of hydro electric energy enables our manufacturers to secure cheap power, thereby reducing the cost of the commodities they produce. The construction and expansion of our railroads, the improvement of our highways and the development of our canals, all have the economic aspect as their ultimate accomplishment, tending to reduce the cost, and facilitate the carrying of the goods from the producer to the consumer. The same may be found true in case of many other engineering works where the ultimate economic benefit enters into their consideration. The enormous expansion of railroad construction that took place in the United States during the period following the Civil War has materially assisted in the readjustment of the country at that time by decreasing the cost of distribution of products. It is very probable that the deepening of the St. Lawrence waterway and similar other projects which are likely to come in the very near future, will similarly assist and facilitate the readjustment which we are undergoing at present.

However, in the consideration of the principles governing the movement of prices, the writer has not confined himself to the prices of engineering or construction materials, but dealt rather with commodities in general, because the same principles that apply to general commodities will likewise apply to construction materials.

The Origin of the Recent Rise in Prices

Many people are in the habit of thinking that the recent rise in prices began with the breaking out of the European War in 1914. Most of our comparisons in prices are usually made with those that prevailed either in 1913 or in 1914, and the blame for the increased prices is attributed entirely to the War. But as a matter of fact, a steady rise in commodity prices had been observed in this country as well as in Europe for a number of years prior to the war. Those increases were, however, comparatively slow and gradual, and it was chiefly during the latter years of the war and particularly immediately after the conclusion of the Armistice that price increases have assumed such enormous proportions, that all our former standards of comparison of values were thereby entirely upset; resulting in considerable misery and hardship to people who were not in a position to benefit themselves from the rising prices but who found that with a given amount of money they could no longer obtain as many commodities as they were getting formerly.

The class of people that were first affected by the increased cost of living were naturally those whose incomes were of a fixed nature, such as people who depended on annuities or pensions for their living, or those whose incomes were derived from investments in mortgages and long term bonds, the return on which was a definite and constant amount that could not be changed. These people found it necessary to lower their standard of living if they were to live within the means of their income. As price increases gained momentum, other classes of the population were gradually added to the category of those who were compelled to reduce their living standards. Salaried people were probably the largest single class to suffer from the higher cost of living, because only in isolated and remote cases were salaries raised to any such extent as would compensate for the rising cost of commodities. Organized labour, by means of their strong organization, and because of the increased demand for labour as a result of war activities, were at first able to demand and enforce considerable increases in wages. But as these wage increases were in themselves factors tending to raise prices still higher, the result was the creation of that vicious cycle of which we heard so much during 1919 and 1920, and which merely had the effect of aggravating a situation which had already become too serious to be ignored.

As a consequence, wide spread discontent and restlessness developed throughout the country. Efficiency in industries had considerably deteriorated. Labour strikes were becoming a frequent occurrence, disturbing the trend of business and trade. Coupled as this was with much extravagance and extreme speculation in food stuffs and other commodities, a very unhealthy situation naturally developed.

These conditions received careful attention from the press of the country where considerable prominence was

given to the subject and much space was devoted for its discussion. The ills and evils of the situation were thoroughly discussed. The reasons for their existence were pointed out and various remedies for correcting them were suggested. The profiteer was denounced, the blame for the high cost of living was shifted from one class of business men to another, while the Government was urged to take steps to curb profiteering.

Special agencies, such as the "Cost of Living Commissioner" and the "Commerce Board" were appointed by the Government for the purpose of investigating and dealing with the problem, but apparently even these agencies failed to produce effective relief.

The 1920 Price Collapse

Speculation then became rife as to whether or not the good old prices of 1914 would ever come back. Very few people were willing to go as far as to admit the possibility of that, although some persons were under the impression that a halt to the upward movement of prices was about due and perhaps even a slight set-back. The great majority of people, however, were inclined to the belief that prices would continue climbing higher. This is quite evident from the fact that when finally the turn did come and prices assumed their downward movement, so many people, among them experienced business men and prominent corporations were caught with enormously large inventories purchased at high prices on the expectation, apparently, that they were to go still higher.

It is not surprising however, to find that such should be the case and that people should have expected prices to continue mounting higher, when it is realized that for almost an entire generation commodity prices, except for a temporary halt or occasional slight set back were continuously moving in only one direction, upward.

Under such circumstances it would not be extraordinary for persons who have been observing this fact for the past twenty-five years, to arrive at the conclusion that the rising of prices is only a natural and integral part of our modern civilization and economic system,

Fig. 1

Wholesale Price Index of Commodities in the United States

and that prices must continue to rise so long as our present economic system is maintained.

Yet, if we were to turn the pages of economic history only thirty-five years back we may find that the price movements under our economic system are by no means confined to one direction. We would then arrive again at a period when the price question, particularly in the United States, was very prominent in the public eye. Again we would find the newspapers, periodicals and magazines, giving wide publicity to discussions on this topic and again we would find the Government being urged to take legislative measures to arrest the movement of prices, but with this much difference, that in this period of the historic past around 1885, it was a continuous downward movement of prices that was holding the attention of the public, and it was a downward movement that it was desired to stop. Because up to that time, prices in the United States had been declining continually, though gradually, for nearly twenty years. This decline having begun after the termination of the Civil War, and as it turned out later, a complete turn in the direction of the price movement did not occur until about ten years later around 1896.

It is evident then that an extended period of declining prices is just as much a possibility under our economic system as an extended period of rising prices.

Analysis of Price Movements

A glance at the chart showing the index numbers of wholesale commodity prices in the United States during the past seventy years, reveals four distinct movements. At first we see an upward movement of prices beginning in 1849 and continuing up to 1865, the rise being particularly intensified during the period of the Civil War from 1861 to 1865. This is followed by an extended period of constantly falling prices beginning immediately after the Civil War and continuing until 1896. Then begins another movement of rising prices dating from 1896 and extending through the period of the World War unit the middle of 1920. And finally we find another decidedly downward movement since 1920.

The index curve of commodity prices in England shows similar upward and downward tendencies. Here we find the upward movement coinciding with the period of the Napoleonic Wars, and since then there is a downward tendency until 1896. This tendency was retarded somewhat by three wars, the Crimean War in 1855, the U. S. Civil War, and the Franco-Prussian War in 1871. The year 1896 marks the turning point in the price curve of England the same as for the U. S., the rise continuing up to 1920, and from that day a decided decline in prices is evident.

From observation of these charts it would appear that prices have moved in certain minor and major cycles. The minor cycles being usually of short duration and representing the ordinary fluctuations following the periodical trade cycles of prosperity and depression, while the major cycle, extends for a period covering many years and the upward movement is usually accompanied by an extraordinary event such as an important war which carries prices to such an extreme point that the very height of the price level produces the reaction which sets the pace for the movement in the opposite direction.

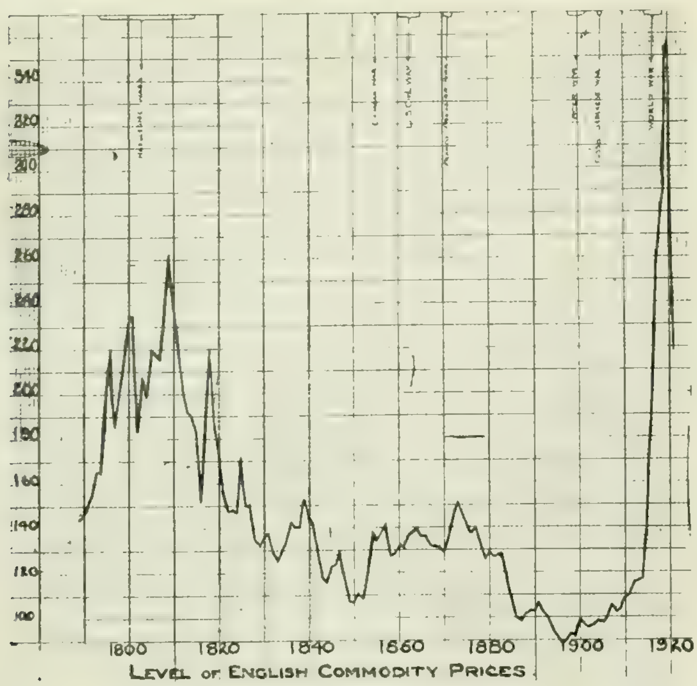


Fig. 2

But what are the factors that are responsible for these variations in the price level? Why do prices of commodities climb sky high at one period and drop to extreme low levels at another period?

These questions have been extensively discussed by economists and various theories have been evolved and suggested.

Factors Responsible for Price Variation

The economic factors that are claimed to be chiefly responsible for variations in the price level of commodities are as follows: — Gold production, expansion of credit and modern banking system, production and consumption of goods, protective tariffs, free trade, freight rates, high wages, high taxes, monopolies, trusts and combinations.

Of those mentioned, the first three factors, namely, gold production, credit and goods are most important, being fundamental in their effect on prices, while the other factors are probably only contributary influences, some of them being themselves the result, rather than the cause of a change in the level of prices.

The effect of gold on the movement of prices is explained by the "Quantity Theory of Money". According to this theory, prices in any given country will vary in direct proportion to the quantity of money in that country. As the quantity of money increases, prices will rise, while a reduction in the quantity of money will produce lower prices. Since in countries that are on the gold standard, the quantity of money bears a certain relation to the gold reserve, it follows that variations in prices will depend on the amount of gold in the country.

The direct manner whereby newly produced gold would exercise its influence in bringing about higher prices is explained by the adherents of this theory in the following way.

Fresh gold produced from the mines will usually find its way to the banks. The banker finding his gold reserve increased much above the required limits established by experience, will naturally look for an outlet for this idle gold whereby he could make it work and earn a profit. His natural course would be to offer a reduction in money rates and thereby induce and encourage borrowing. Traders findings that they can get credit at easy rates will use that credit by entering the market for goods and thereby bidding up prices. This starts the ball rolling, because as soon as prices rise, profits will increase, and that will encourage more people to enter the market, thereby causing greater competition among purchasers of goods. Price increases will spread from one commodity to another until the entire level is raised.

The "Quantity Theory of Money", however, has in recent years been attacked by certain economists who maintain that because of our modern system of banking, whereby many business transactions are settled by means of bank checks without any basic money actually passing from one person to another, and because of the expansion of our credit system, an increase or decrease in the production of gold cannot effect prices in any way. According to these economists, important changes in the price level are produced chiefly by a scarcity or abundance of goods.

What Prices Are

To understand more clearly, therefore, the effect of gold and goods on prices, it is necessary to define the meaning of prices and to recall some elementary principles in political economy.

Prices my be defined as expressions of relative exchange value of commodities in terms of money. If the price of a bushel of wheat is one dollar and that of an overcoat is twenty dollars it is obvious that an overcoat is worth twenty bushels of wheat. It represents the application of our old well known mathematical axiom of "two things equal to the same thing are equal to each other". However, in order that money should act as a standard for comparisons of values, it naturally must in itself have value. Therefore, some commodity must be chosen as a basis for money. Most civilized countries have adopted gold for such basis, because gold fluctuates less in value than other commodities, because it is not very abundant in the world, and because it is not perishable.

In Canada and in the United States, where the unit of money is one dollar, the dollar normally represents a definite quantity consisting of 23.22 troy grains of gold. While prices, therefore, express a relation of value between one commodity and another, they also express a relation between the value of either commodity and that of gold. In the example cited for instance, a bushel of wheat will buy 23.22 grains of gold and an overcoat will buy 20 times that amount, or approximately one ounce of gold. Assuming now that the general level of prices increases 100%, the price of wheat will become two dollars a bushel and an overcoat will cost forty dollars. It is evident then that the increase in prices has not effected any material change in the relation between these two commodities. The farmer will still have to give twenty bushels of wheat before he can secure an overcoat, like-

wise the clothing manufacturer will not be any better off when he comes to purchase wheat. But what about the relation of these two commodities, with regard to gold, after the price level was raised one hundred per cent? There certainly occurred a decided change in that direction, because the dollar being always the equivalent of 23.22 grains of gold, the farmer can now exchange his bushel of wheat for twice the amount of gold that he could have gotten under the old scale of prices, and the same is true of the manufacturer. The same analogy, if carried further to include all other commodities, will show a similar result. It is evident then that an increase in the general level of prices in the same proportion for all commodities will not change their value relation as against each other but will change their value as compared with gold. As commodity prices rise, the value of gold falls, and when prices of goods fall, the value of gold rises. This being so, it is difficult to see how the opponents of the gold theory can ignore the effect of gold on prices.

The exchange value in the open market between one commodity and another, is governed chiefly by the extent of the demand and supply. If a commodity is scarce in the market at a time when there is a considerable demand for it, its value and price will rise as compared with other commodities. On the other hand when there is an abundance of a certain product and no demand exists for it in proportion to the supply, its price is likely to fall.

Effect of Gold Supply on Prices

Now, gold being itself a commodity, the production of which requires land, capital and labour, the same as the production of other commodities, its exchange value as compared with other goods must also be governed by demand and supply. A considerable increase in the supply of gold should therefore eventually cause a depreciation in its value resulting in a rise in commodity prices. On the other hand, a decreased supply coupled with a keen demand for gold should produce the opposite result causing lower commodity prices.

The same should also be true in the case of goods, a great supply of goods should result in lower prices, while a scarcity of goods should have the effect of raising prices.

It is obvious then, that in considering the price making factors we are dealing with two sets of forces of opposite character, which are constantly acting upon both gold and general goods tending to change their relative strength. The resultant of all those forces is the general price level of commodities at any given time. Any force that would tend to increase the production of gold, either through discoveries of new mines or through the development of new processes, whereby lower grades of ore could be profitably worked, or through the introduction of new machinery and improvements in the mining and milling of gold, will have a tendency of raising the general price level, while exhaustion of gold mines, and high cost of producing gold through high wages and high cost of materials used in mining, will have a tendency to reduce the supply of gold and accordingly lead to lower prices. The employment of credit inasmuch as it enables the carrying on of many business, transactions on a small reserve of gold tends to decrease the demand for gold to that extent, and therefore the credit system may also be considered as one of the factors tending to raise prices.

Of the forces, on the other hand, that work on the goods side of the ratio, all those that lead to increased production of commodities, such as substitution of machinery for hand work, improved transportation facilities, increased efficiency, subdivision of labour, introduction of new inventions and improvements, will have a tendency to reduce prices. Factors causing retardation in production and distribution, such as decreased efficiency and poor transportation will lead to higher prices.

United States Prices since the Civil War

In the light of these economic principles let us examine how the major price making factors that have been discussed, namely, gold production, credit and goods, have actually operated in producing the price curves which we have seen. For this purpose the writer has chosen to analyze the price movements in the United States, because of the splendid opportunity it affords of comparing the circumstances surrounding the Civil War and those which have existed during the recent War. Insofar as recent price movements are concerned, while they may have varied in degree and intensity, the general trend, however, has been the same in Canada as in the United States, the discussion therefore, of the conditions in recent years will apply likewise to Canada as to the United States.

The rising movement of prices, which began in the United States in 1849, coincides closely with the important gold discoveries in California. The gold production of the U. S. which was only slightly over a million dollars in 1845, rose to 10,000,000 in 1848, to 40,000,000 in 1849, and reached a figure of 65,000,000 in 1853. From that year production of gold was gradually declining and the figure of 1853 was not reached again until 1898. The price increase of 1849 is easily explained therefore by the increased gold production. The reaction in 1858 was probably due partly to the financial crisis of 1857, and partly to the uneasiness and uncertainties incident to the anticipated Civil War. With the outbreak of the Civil War prices re-assumed their vertical climb, because of the extreme demand for goods required for the provisioning of the army. This demand coming on a reduced supply occasioned by decreased production due to the withdrawal of men from the producing industries into the armies would naturally raise the price of the goods.

Another element which undoubtedly contributed to some extent to the rise in commodity prices during the Civil War, was the depreciation in the currency of the United States. At the outbreak of that war, the Federal Government found itself badly in need of funds. Accordingly an issue of a large amount of paper money in the form of legal tender notes was authorized. As there was considerable uncertainty and lack of faith as to whether these notes would ever be redeemed in coin, their value naturally depreciated to a considerable extent and at one time the paper dollar of the United States was worth less than fifty cents in gold. Depreciation in the money of a country, nearly always leads to speculation, and speculation on the other hand, is practically always accompanied by rising prices.

Once the Civil War was over, the abnormal demand for goods ceased and prices began to drop. Because of the extreme speculation and overtrading that immediately preceded the conclusion of the war, the drop in prices immediately after the conclusion of the war was very steep. This was assisted materially by the fact that a large number of the population that were engaged in the prosecution of the war were now released and turned back into the various industries to produce goods. Furthermore, producers and manufacturers who, under the stimulus of the war demand assisted by certain protective tariff measures, had considerably enlarged their plants and expanded their business, suddenly discovered that the productive capacities of their plants were far above that which the normal pre-war demand would have justified. In seeking an outlet, therefore, for their products, competition among producers which practically did not exist during the period of large demand, now became very keen. Special inducements in the form of price reductions had to be offered in order to dispose of materials. Under such circumstances it is evident that the law of "Survival of the fittest" must hold true, and the one who is able to undersell his competitors, would be the one who would remain in the field.

Producers and manufacturers, realizing that their salvation existed only in being able to produce at low cost and sell at low prices, had to bend all their energies in that direction. Accordingly many economies in the production and distribution of goods were introduced. Efficiency was improved and new improvements in the form of machinery and inventions were adopted. These improvements had the effect of decreasing the cost per unit of product but at the same time they also resulted in increasing considerably the total quantity produced which fact tended further to bring lower prices.

It is quite generally recognized that the fall in prices in the United States after the Civil War, was due to improvements in production caused by the introduction of new machinery and inventions. But what is not generally recognized is the fact that these improvements themselves were partly the result of falling prices. Necessity is the mother of invention. Introduction of improvements frequently means considerable loss of time and money in the way of experimenting, it means discarding old machinery in which considerable capital may have been invested. During times, therefore, when prices are high and profits are fair, producers are not inclined to undergo those losses. It is only during falling prices then, that the greatest stimulus is given to the introduction of new machinery and inventions.

It is clear then that all the forces that were operating on the production of goods during that period were tending towards lower prices. But it is also a fact that the forces that were acting on gold during that period were also operating in the same direction. In this connection it is well to remember that after 1873 falling prices became a world wide affair, and what is true after that year of the United States is true of practically every other civilized country insofar as the price making factors are concerned.

The world's gold production was gradually declining since 1853, when the production of gold was 155 millions dollars. In 1874, gold production amounted only to 91 millions of dollars, while between 1860 and 1889, the annual production never rose above 121 millions of dollars. The mere fact that gold production remained practically stationary during a period when the development of the commerce of the world had made tremendous progressive strides would in itself have been sufficient to appreciate the value of gold. But in addition to this, there were also other causes tending to enhance the value of gold. There was created a great demand for gold occasioned by the desire of one country after another to adopt the gold standard.

The United States adopted it in 1853, and while specie payments were suspended during the War, they were resumed in 1879. In 1871, Germany adopted the gold standard, and later the countries of the Latin Union, Austria Hungary and other countries.

This increased demand coming on a reduced supply, the result is quite obvious, it enhanced the value of gold and accordingly, prices continued to drop throughout the world.

Gold production did not overtake production of goods until the early nineties of the last century, when due to the discoveries of the South African gold mines and to the successful application of the cyonide process in the treatment of ores, the output of gold began to increase rapidly. Gold production of the world which amounted to 120 millions dollars in 1890, rose to 180 millions in 1894, it stood at more than 300 millions in 1899, and was about 450 millions in 1910.

The Rise in Prices since 1896

The rise in prices, therefore, throughout the world, which began in 1896, can be easily explained by this enormous production in gold which resulted in a depreciation of its value. Coupled with this, came the enormous expansion of credit, whicht ended at the same time, to diminish to some extent the demand for gold.

Some economists have attempted to attribute rising prices after 1896 to high wages and to activities of labour organizations in their attempt to retard production. But it is a fact that while prices from 1896 to 1907 have risen about 50 per cent. wages during the same period have risen only 30 per cent. So that the purchasing value of a day's labour actually decreased during that period. While during the period of falling prices, the purchasing value of a day's labour actually increased 80 per cent. from 1860 to 1892. With regard to activities of labour unions, it would appear that this was not a new phenomenon which was confined to the period of rising prices. Writing on this subject in the Century Magazine, as early as 1887, E. Atkinson, referring to activities of trade union organizations, describes them in the following way: "The attempt is made to control the hours of labour by various artificial methods...Other attempts are made by establishing stated lists ofprices, by limiting the quantity of work to that done by any one man, by limiting the number of apprentices and by other similar methods to equalize the material conditions of men". These were apparently the conditions existing during the period of falling prices and if these activities could not prevent the falling of prices before 1896, how can they be considered to be responsible for the rise after 1896.

A high protective tariff in any country would undoubtedly tend to raise the prices of certain commodities in that country, because it would eliminate outside competition, thereby facilitating the formation of combines for price fixing purposes. But on the other hand, it is a fact that the upward movement of prices after 1896, appeared alike in free trade countries as well as in tariff countries. It is difficult therefore, to blame the tariff entirely for the rising of prices.

With regard to the effect of large trusts on the movement of prices, it must be admitted that while on the one hand, the tendency is towards higher prices through the elimination of competition, there is, on the other hand, the fact that centralization of management, and large scale production makes it possible for commodities to be produced at a lower unit cost tending therefore, also to lower prices.

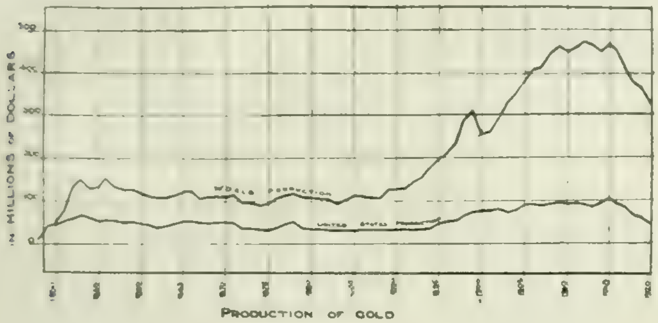


Fig 3

The enormous increase in the world's gold production would appear therefore to have been the most important factor in producing the rise in prices which began in 1896.

The rapid rise in prices incident to the War is familiar to all. It was caused by a shortage in goods and by speculation which was brought about by this shortage. This shortage first appeared in such products as were required for the provisioning of the armies such as food, clothing, boots, munitions, etc. Because of the increasing demand for such articles, prices rose and were accompanied by large profits and high wages. This induced the diversion of capital and labour from industries manufacturing peace time goods into those producing war materials. In addition to this, a large number of young men were withdrawn entirely from all industries, and turned into the armies and navies. This brought about a shortage of goods in all industries, raising the prices of all commodities.

Prices of commodities did not drop immediately after the conclusion of the Armistice. This was due to the fact that this war was world wide and affected the people of many countries and of many nations. For four years these people had suffered from under consumption due to blockades, and to the limited quantities of goods available. For four years they had to deprive themselves not only of comforts, but of actual necessities. When the lid was lifted, therefore, and the days of sacrifice were apparently over, they all began to purchase again. All wanted to get the things they could not get before, and wanted it as soon as they could possibly get it. This sudden increased demand, coming after a considerable period of under production, brought about the enormous rise in prices which we have witnessed during 1919 and 1920.

Prices began to drop in 1920, and continued falling for over a year. During the past six months, the price level remained practically stationary, declines in some commodities, balancing advanced in others. But it does not seem as if the general fall in prices had actually reached bottom as yet. It is more likely that the downward movement will still continue for a considerable number of years, although the declines may be slower and more gradual than they were during the past year. There are many indications pointing in that direction. The enlarged capacities of our producing plants expanded during a period of abnormal war demand, the decreased purchasing power of European countries caused by their adverse currency exchange, the decreased gold production and the probable increased demand for it as soon as the European countries make any attempt to correct their currency value by returning to the gold standard, will all tend towards reduced prices. The fact that the prices of some commodities have already come down very low, thereby reducing the purchasing power of the people engaged in those industries, will force lower prices in such commodities that are still kept above a reasonable level. There is still a considerable spread between the wholesale and retail costs of commodities and for this reason, consumers have not always enjoyed the benefit of the fall in prices, it is likely therefore, that many corrections will yet take place along that line.

Prices and Wages

A question which is frequently discussed in connection with commodity prices is, that of the price of labour. If prices are to continue declining for a long period, will wages also decline too the same extent?

If wage movements of the past could be taken as any criterion for the future, then it would seem as if the level of wages will not decline to any great extent. Wages do not appear to follow the same curve as prices. Following the Civil War, while prices kept on continually falling, wages which also rose during, and immediately after the war, came back but slightly, and finally remained on a permanently higher level. Certain data collected in England on this subject and covering a period of several hundred years would also appear to indicate that when wages have once risen to a higher level they never fall back to the original level. Perhaps this may be one of the secrets of our economic system which apparently aims and leads towards greater comforts and better living standards for the great masses of people. Price rise and wages follow, prices come down, but wages remain high.

But, it may be asked, how is it possible to reduce the prices of goods while wages still remain at a high level? And the answer that history gives us to this question is this, *Engineering, Science* and *Inventions* will make that possible. These are the elements that were always chiefly responsible for the constantly increasing purchasing value of a day's labour, and it would appear that it is to the development of engineering and science

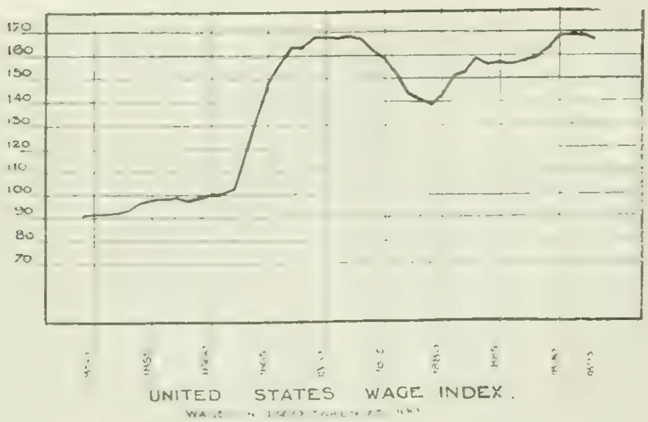


Fig 4

which would make possible the production and distribution of goods at low costs that the world will have to look in the near future, for relief from the present economic difficulties.

The significance of this statement, which would indicate that developments of scientific and engineering improvements will likely play a most predominating part in the economic world readjustment, is of extreme importance to the engineering profession. Because, if it means anything at all, it means that the opportunity is at hand when engineering might become the leading profession of the world. It is claimed that at various periods in the history of humanity, different professions have assumed leadership. At one time it was the clergy that occupied the leading position in the community, then came the medical and later the legal professions, which have similarly occupied leading places. Is it not possible, therefore, that in the coming generation when the entire world must look to science to extricate them from their economic difficulties, is it not possible that the engineer may be placed in that leading position? Is it not possible that very shortly we may find that conditions have so developed that the engineers and scientists are in a position where they are able to render extreme valuable service to humanity?

But if such are the conclusions that an analysis of the present and prospective economic conditions lead us to assume, may we not, on the other hand, ask ourselves the question, when that time does come, is the engineering profession prepared to assume such leadership? It will not do, of course, to ignore the fact that in recent months some very severe criticism has been levelled at the engineering profession, it being claimed that for some reason or other, the engineering profession does not develop the type of men that the public requires and expects it to furnish. When we realize that this criticism came from men who are friends and not enemies of engineering, it lends colour to the belief that there must be some justification for the criticism.

How Engineers May Help

Some five or six months ago, in an address before a joint meeting of Engineering Societies, Mr. Philip Cabot, a Boston broker, frankly and openly told his engineering audience that the opinion of the financial world is, that there is something wrong with the engineering profession, that it does not develop the kind of men that modern ndustry and the financial world demands.

Following a similar trend in a recent address before the American Association for the Advancement of Science, R. C. Harris, commissioner of works for the City of Toronto, expressed similar views when he claimed that the engineer does not fully appreciate the economic aspect in the development of engineering works.

Both Mr. Cabot and Mr. Harris have rendered the profession a most valuable service by giving us an opportunity to see ourselves as others see us. But has the profession done anything to avail itself of this service and benefit by it? Has any engineering organization taken up this criticism and seriously investigated the causes for it or suggested any remedies that would eliminate it? So far as the writer is aware no such official action has been taken by any society and had it not been for a few editorials in the engineering press, the matter might have been ignored altogether. Yet it is the members in the various engineering societies who are most vitally concerned in this question, and in view of the great hopes that the future holds for the engineering profession, the engineering organizations cannot afford to ignore or remain indifferent to this criticism. If there is really something radically wrong with our profession, is it not our duty to take the necessary steps to correct it? If on the one hand, the public has shown its faith in the engineering profession by giving it a legal status in the various provinces, it certainly becomes the duty of the engineers on the other hand, to make their profession one of the highest order and to develop its members to render the public the highest service, and anything that hinders such development should be eliminated.

These suggestions are made in the hope that they may lead to the appointment of a special committee by this Branch, (Toronto) to look into this question in the meantime, and discuss it more broadly at some future date, when other Branches may take up the same question.

In conclusion, there is only one other matter the writer would like to touch upon.

Prosperity and the Falling Market

Many people are under the impression that falling prices must be accompanied by hard times, unemployment, and lack of prosperity. There is nothing to justify such an opinion. The greatest prosperity enjoyed in the history of the United States, was during the period following the Civil War, and up to 1873. It is true that during falling prices, there is no inducement for speculation, but it still has to be proven that speculation is a desirable element in the development of a country.

John Moody, the well known statistical economist, expresses a similar opinion, when he says: "It looks like a parodox, but greater real prosperity can exist during a long period of declining costs than during a long period of boom.... The restoration of the price level to 1914 or below, will mean an advance of the purchasing value of the dollar to the level of 1914 and above. The necessity of doing business under more direct competitive conditions and on smaller margins of profit, makes for efficiency in every direction. With the elimination of easy speculative profits, men get down to work and produce; and it is efficient production that builds up civilized countries — not speculation."

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THE

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Montreal and Winnipeg

Those who were fortunate enough to be present at the Annual and Professional Meeting, held in Montreal, agreed that the various functions were of an enjoyable nature, and would result in considerable benefit to the profession. It is not generally known, however, that practically all the details in connection with the various meetings were handled by the members of the Executive of the Montreal Branch, and that they had only a few weeks' notice in which to prepare their programme, and therefore, particular credit is due all who took part in connection with the arrangements for the Meeting, handicapped as they were on account of the time at their disposal.

It should be pointed out that the postponement of the Winnipeg meeting to September 5th, 6th, and 7th, in no way detracts from the importance of this gathering, but rather, since it is being held at a season considered more opportune, it is expected that the Winnipeg meeting will not be second to any of the memorable engineering gatherings held in recent years. Not only do the officers of the Winnipeg Branch extend a most cordial invitation, but the President of *The Institute*, John G. Sullivan, M.E.I.C., being a resident of Winnipeg, is looking forward to the pleasure to meeting a large number of his fellow members at that time.

At the conclusion of his retiring address, President Fairbairn, apropos of the absence of the newly elected President and of the Winnipeg meeting, said:—

> "Gentlemen, at this stage of the proceedings it is customary to bring to the chair of office the new President. I am sorry to say to-day that our new President is not with us. I had a letter from him yesterday, in which he expressed his most sincere regret at his inability to be present, owing to the fact that some very important business matters in Winnipeg prevent his leaving there. He also asks that I give one and all a most hearty invitation to be present at the professional meeting to be held in Winnipeg next September, and he specially requested that that be emphasized in every possible way.
>
> September is a most pleasant month in which to go to Winnipeg. It is the time of year when the Province is harvesting its crop, and making money, and I do not know of any better time to go there I hope everybody present will be able to go to Winnipeg in September, and have an opportunity of meeting your new President. He is a good fellow, and you will realize what that means."

Mining and Metallurgical Institute Meeting

Members of *The Institute* will note the courtesy of the Canadian Institute of Mining and Metallurgy through their Secretary, Mr. George C. Mackenzie, B.Sc., in inviting the executive officers and members of *The Engineering Institute* to their Annual and General Meeting at the Victoria Memorial Museum, Ottawa, from the 1st to the 3rd of March, 1922. In order that this invitation should be received by all members before the meeting, a copy of Mr. Mackenzie's letter was forwarded to the twenty-two Branches of *The Institute*, and no doubt, has already come to the attention of a great majority of the members. At the recent Council meeting the action of the Canadian Institute of Mining and Metallurgy was warmly appreciated. Mr. Mackenzie's letter reads:—
Dear Mr. Keith:—

On behalf of our Council, I have the honour to extend to your Executive Officers and Members a cordial invitation to attend the forthcoming Annual and General

Meeting of this Institute, which will be held at the Victoria Memorial Museum, Ottawa, Ontario, from the first to the third of March, 1922, inclusive.

Yours faithfully,

(signed) *Geo. C. Mackenzie.*
Secretary-Treasurer.

Papers Committee

An innovation in the personnel of the Papers Committee has been made this year, which will doubtless react beneficially to *The Institute.* It has been customary for Council to appoint the Chairman, who with the Chairmen of the various Branches, comprised this Committee. In view of the importance of the work of the Branch Secretaries, and the close contact they have with *Institute* affairs and of the details concerning their own Branch meetings, it was suggested by the Chairman of the Committee that for the coming year, the Secretaries of the Branches constitute the personnel of this Committee. This suggestion was approved by Council, and consequently, the Papers Committee for the coming year, in addition to the Chairman, Frederick B. Brown, appointed by Council, is, O. S. Cox, K. G. Cameron, Harry F. Bennett, M. J. Murphy, Hector Cimon, J. L. Busfield, F. C. C. Lynch, D. L. McLaren, L. T. Rutledge, F. B. Goedike, W. F. McLaren, Geo. C. Wright, Rex P. Johnson, J. Clark Keith, F. T. Gnaedinger, Geo. L. Guy, D. A. R. McCannel, C. M. Arnold, R. H. Douglas, Arthur L. Ford, P. H. Buchan, and H. M. Bigwood.

Leonard Medal Award

The Leonard Medal Committee has recommended and the Council has approved of the award of the Leonard Medal for nineteen hundred and twenty-one, to John Ness, for his paper on "Search for Oil in the West," published in the April 1921 Bulletin of the Canadian Institute of Mining and Metallurgy.

Research Problems

An attractive pamphlet has been issued by the Honorary Advisory Council for Scientific and Industrial Research, of which R. A. Ross, D.Sc., E.E., M.E.I.C., is Chairman, and Colonel F. M. Gaudet, C.M.G., M.E.I.C., Technical Executive Officer, which deals with research, and the problems of unemployment, business depression, and national finance in Canada. It points out the necessity for research in Canada, if this country is to maintain a position of leadership in the industrial world, and advocates the establishment of "The National Research Institute" to provide facilities for conducting research in the public interest, carry on a special confidential study of commercial problems, and provide a Bureau of Standards, maintaining a library for public use, and carry on a continuous study of Canadian materials.

Following are some of the questions requiring to be answered, and which the Research Bureau might undertake.

Who knows the secret of exterminating wheat rust?

No one. Yet by organized and perhaps long sustained research it can be discovered and meantime lack of this knowledge costs Canada and her farmers millions of dollars per year. Valuable work has been done on this subject under the Department of Agriculture and the Advisory Research Council, but much still remains to be done.

What should a black fox eat?

How can this precious little fur-bearer be protected from the ravages of worms? In the answer lies millions of dollars for Canada, and important steps towards the solution of the question have already been taken.

What use can we make of our tremendous supply of Helium? It was greatly needed during the war as a gas for filling balloons. It will not burn—and at war-time prices, Canada is wasting $50,000,000 worth every day of the week.

It is contained in our natural gas and escapes unused into the air. Can we find another use for Helium besides the filling of balloons? Here is enough money to wipe off our railway deficit. The Research Council has promoted the study of this question; the material is available; it is now a matter of finding uses, in time of peace, for this gas of which Canada can become one of the largest producers.

How can Canada be put into a position to meet its own heavy and increasing demands for fuel?

How can the great supply of Lignite in the West and of Peat all over Canada be utilized for this purpose?

The study of these questions, begun by the Department of Mines, at Ottawa, and pushed on by the Advisory Research Council, has reached a point where success is in sight.

What practical way can be found of developing and using the enormous quantities of low grade iron ore that exist in Canada?

This too has received attention. Much has been done though much remains to be done, and the answer cannot fail to be of immense importance to this country.

What can be done with our straw?

What can be done with our saw-mill waste?

What should be done with our liquor from sulphite mills?

What about making artificial fertilizers by the use of our water-powers?

These are some of the problems awaiting Canada's Bureau of Standards and Research; problems which have engaged the attention of the Advisory Research Council, with promising and even valuable results.

Copies of this pamphlet are available to any member of *The Institute* on application to Colonel Gaudet.

Engineers not Employed

While it is not possible to assure members that Headquarters can secure positions in view of the present conditions, it is earnestly desired that all members at present unemployed record that fact at Headquarters, in order that *The Institute* may be better able to serve their interests. Although the outlook for engineering undertakings for the coming year is not promising, it is expected that the next month will see considerable more activity, and consequently a better opportunity of securing positions for those not now engaged.

Besides the actual record of those of our members who are out of work, it would be of interest to know the number of technical men not employed, and any information on that subject will be gladly received.

Assisting Student Members

In a short time the hundreds of students now attending engineering colleges in Canada will have concluded their year's studies. Most of them depend on the work they secure during the summer to assist them to complete their course.

During the last few years a great many students have joined *The Institute* as Student members, demonstrating that they are ambitious to improve their standing in the profession. These same students realize that they need practical experience in engineering, and so desire employment in some capacity on any such work.

A list will be published in *The Journal* next month of Student members available for this summer. Members of *The Institute* will then have a very practical way of assisting and guiding the future engineers along the difficult path of their chosen profession.

Canadian Engineering Standards Association

Arrangements have been made with Capt. R. J. Durley, M.E.I.C., whereby every Branch Secretary of *The Institute* will be placed on the mailing list of the Canadian Engineering Standards Association and will receive all publications, both past and future, issued by the Association. The courtesy of the Engineering Standards Association in this connection will be appreciated by all Branches.

Meeting of Branch Secretaries

A meeting of the Eastern Branch Secretaries of *The Institute* was held at Headquarters on Jan. 26th last, immediately after the conclusion of the Annual and Professional meeting. There were present Messrs. Cox of Halifax, Cameron of Sydney, Bennett of St. John, Murphy of Moncton, Busfield of Montreal, McLaren of Peterborough, Goedike of Toronto, McLaren of Hamilton, Wright of London, Johnson of Niagara Falls, Clark Keith of Windsor, and Barnhill of Sault Ste. Marie.

The chair was unanimously tendered to Mr. Busfield of the Montreal Branch and J. Clark Keith, A.M.E.I.C., of the Border Cities was unanimously appointed secretary. Telegrams of regret were received from Mr. Lynch of Ottawa, Mr. Cimon of Quebec, and Mr. Rutledge of Kingston.

The meeting was opened by each of the Secretaries explaining the principal features, the organization of their Branches and matters of general interest regarding his own Branch. Following which, a discussion was held on the standardization of Branch by-laws and the conclusions were reached that all Branches should take provision in their by-laws for the selection of a Vice-Chairman by ballot; that the Secretary-Treasurer or Secretary and Treasurer be appointed by the Executive committee instead of by ballot; and that all Branches should adopt the calendar year so as to conform with *The Institute*. With regard to this latter point it was felt that difficulties might ensue owing to the change of officers in the middle of the meetings season, but it was explained that this could be avoided by appointing a papers committee to take office in January to obtain papers for the following winter season.

There was a general discussion on the relationship of Branch by-laws and Institute by-laws and it was felt that it was desirable that there should be no conflict between the two sets of by-laws, and a resolution was therefore passed requesting Council to appoint a committee to deal with the question of uniformity of Institute and Branch by-laws.

Ways and means of obtaining greater publicity for the Branches and Institute were discussed at great length, the various Secretaries explaining their own particular ways of handling this matter. Regarding personal service to the membership, particularly in connection with employment, it was thought that little could be done at the present time due to the abnormal conditions. However, each Secretary pledged himself to do everything in his power to impress on those seeking the services of engineers the desirability of giving preference to members of *The Institute* and also to seek the advice of *The Institute* in making appointments.

Fraser S. Keith, General Secretary of *The Institute*, joined the meeting during the afternoon session when a discussion was being held on the desirability of extending the jurisdiction of Branch membership. It was the general feeling that it would be desirable for non-resident members to be brought within the jurisdiction of the nearest branch but that their fees should not necessarily be changed from the present standard.

It was felt that there was considerable difficulty in obtaining suitable speakers particularly in the case of the smaller Branches. Their finances did not enable them to contribute towards the expenses of a visitor and in their own Branches they only had a limited amount of material. A resolution was passed requesting Council to assist the smaller branches by suggesting good speakers and making an appropriation to assist in paying the travelling expenses of such speakers.

A large part of the time was devoted to discussion regarding *The Engineering Journal* and general activities of the Branches particularly regarding ideas for improved attendance at meetings and for making the meetings as attractive as possible for the membership.

The Secretaries felt that the meeting was of great value not only to themselves but through them to *The Institute* at large, not only on account of the information and ideas that were being assimilated but also on account of the inestimable value of personal contact and acquaintance. It was very strongly felt that it would be a great pity if the co-operation being secured through this meeting should not be ensured for the future by making definite provision for all Branch secretaries to meet every year at the time of the Annual and Professional meeting. The meeting concluded with a hearty vote of thanks to the Montreal Branch for holding this first secretarial meeting and to Mr. Duchastel for the hospitality which he had extended to all present.

George Montefiore Foundation

It is announced by the Association des Ingénieurs Electriciens Sortis de l'Institut Electrotechnique Montefiore, Rue Saint Gilles, 31, Liège, Belgium, that a competition under the rules of the George Montefiore Foundation will be held in 1923. A prize amounting to the interest on Belgian securities amounting to 150,000 francs is presented for the best original work on the scientific advance and the progress of technical applications of electricity. Entries for the competition may be written in English or French, but must be type-written. Further particulars may be obtained from the Association des Ingénieurs Electriciens Sortis de l'Institut George Montefiore at the address given above.

American Association for the Advancement of Science, Toronto Meeting, 1921

A. M. Reid, S.E.I.C.

The following details of the methods used in directing the activities of the allembracing American Association for the Advancement of Science, and in particular the stagecraft employed in connection with the now historic Toronto Meeting, may be of interest.

The central and permanent headquarters is small for an Association of such proportions. This results from the fact that the American Association for the Advancement of Science is little interested in the promotion of special policies or enterprises and so needs little administration during the year. Its chief object is to assist the many Societies, which have affiliated with it, to function properly and provide a medium for them for the expression and co-relation of ideas through annual meetings held in conjunction with the central organization.

The problem confronting the Local Committee formed to arrange for the Toronto Meeting was, therefore, largely one of co-ordination, rather than the execution of detailed plans from Headquarters. Toronto representatives of the sixteen sections and many affiliated societies, representing every branch of science, pure and applied, were appointed by those concerned.

Fourteen sub-committees were formed to arrange the many details and the Local Committee Headquarters became a clearing house for information which was passed on to those interested.

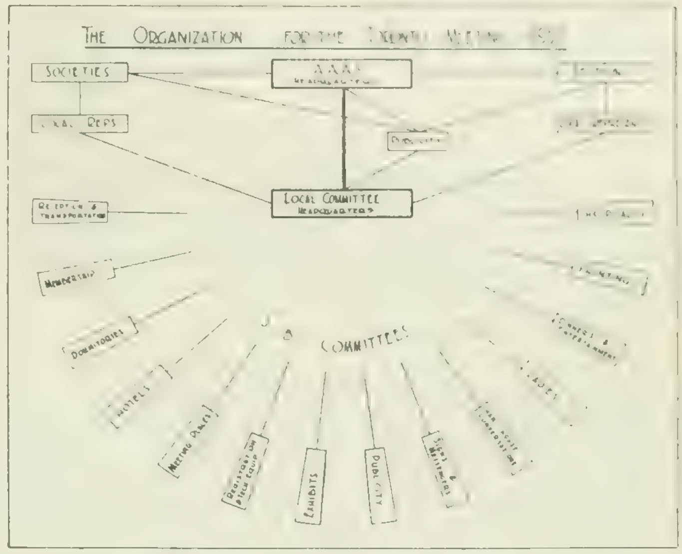


Figure 1

After contact had been established with the affiliated and associated societies and the sections, the fullest possible information for a "Preliminary Announcement" was forwarded to the A. A. A. S. Headquarters for printing in booklet form and distribution.

Special attention was then directed to the collection and compilation of data, and for this a schedule on tracing linen, revised constantly, was used. As information accumulated as to Societies attending, probable attendance, times and location of meetings, etc., it was added, and blue prints and photostats supplied to sub-committees for guidance.

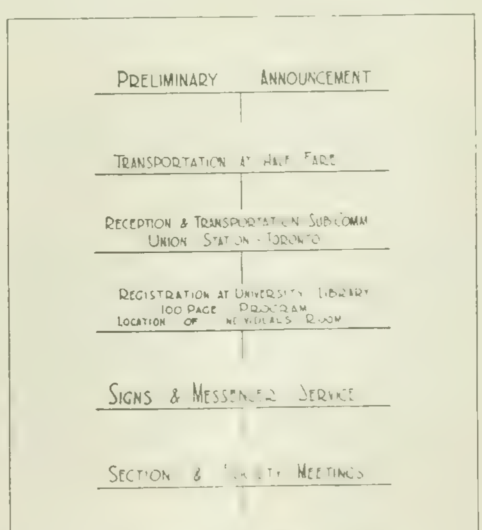


Figure 2.

It was speedily realized that publicity was a most important factor and special liaison was secured with this department by having the Local Committee Secretary, H. L. Seymour, A.M.E.I.C., as Secretary of the Publicity Subcommittee.

Copy was first supplied all technical periodicals and journals. Efforts were made to interest the Secondary School teachers through the University Extension organization, and special circulars to members of the Toronto Board of Trade and similar boards in outlying centres were distributed.

The Publicity Committee concentrated, however, on the daily newspapers and the general reader. To this end a large number of cuts of special speakers and local participants was made. Everyone delivering a paper, of which there were some seven hundred in all, was asked to forward abstracts. These were gone over by a staff of experts in the branch of science treated, and largely rewritten for the general reader. Then, previous to the delivery of the address, some hundred mimeograph copies were made and released for publication. That this was successful from the newspapers viewpoint is shown by the fact that the "Globe" mentioned it as "the first successful attempt ever made in connection with any convention in Toronto to provide a real publicity service".

When the matter of temporary assistance during the meeting arose, it was considered that the University student was the logical employee. A staff of some 110 students was built up on paper and individuals notified as to positions and sub-committees employing them. A corps of sign writers, drawn from the Faculty of Applied Science, designed a number of large and arresting signs, including ground plans on canvas, showing the University buildings being used for meeting places, dormitories and dining halls.

At the result of these preparations, no great difficulty was met with in caring for the actual meeting. The progress of the individual delegate was scheduled from the time he stepped off the train.

A special feature of the registration room was the "visible directory" — a series of slots for the insertion of slips, arranged vertically under the initial, by which one could ascertain whether a member was in attendance, and if so, his hotel or residence, etc. Students on service committees wore distinguishing badges. A feature which might be given more attention in other conventions was the effort to minimize the cost by placing delegates in University dormitories and keeping the charge for functions as low as possible.

The value of such organization was recognized in an enthusiastic manner by the officials and delegates, and *The Institute* may well be proud that so much of the success was due to the presence on the committees of well-known members, mentioned in previous articles, to whose foresight and executive ability the smoothness of operation whch characterized the meeting can be largely attributed.

EMPLOYMENT BUREAU

Situations Vacant

Representative for Montreal

Representative for Water Tube Company (American) wanted for Montreal and vicinity. Company has been established twenty-five years. Boiler is used mainly for heating schools, houses, theatres and public buildings. Apply Box 213.

Civil Engineer Superintendent

Wanted a technically trained Civil Engineer Superintendent who has had experience in breaking up and removing large masses of rock, such as very heavy railway cuttings, iron or copper open pit work or big hydraulic canals. Vacancy is for large English company in Spain. Single man and College graduate preferred and Steam Shovel experience in hard rock essential. Box 212.

Steam Shovel Foreman

Also wanted practical Steam Shovel Foreman to manage and instruct Steam Shovel drivers and manipulators.

Reply stating full experience, salary expected, age, married or single, if any knowledge Spanish to — Box 212.

Representative for Heat Treatment

Representative for Eastern Canada wanted for Surface Hardening and Carburizing Compounds. Attractive proposition offered. Apply Box 214

Situations Wanted

Mechanical Engineer

A.M.E.I.C., mechanical engineer in charge of construction and maintenance for the British America Nickel Corporation since March 1919, owing to disbanding of staff desires position. Previous experience includes engineering products, pulp and paper mills, steelworks maintenance. Designer of improved lines of pumping plant. Certified Member of American Association of Engineers. Age 32, married. Apply Box 89-P

Civil Engineers

Royal Military College Graduate 1903, A.M.E.I.C., At present employed in charge of responsible work. Would like a change. Location immaterial. Fifteen years in responsible charge of surveys and construction on canals and railways in Canada and overseas. Served with distinction in the Great War. Apply Box 88-P.

B.A.Sc., (Honours) U. of T., A.M.E.I.C., married, age 36. Ten years experience on surveying, railway construction, reinforced concrete bridges, sewers, waterworks, reinforced concrete and mill construction buildings as engineer in charge of construction. Open for engagement on short notice. Would like position with firm of contractors or as sales engineer. Apply Box-90-P.

Members Exchange

Books for Sale

Transactions of the Institution of Civil Engineers from Volume 1 to 1836 to Volume 120 of 1894-5, complete except the years 1843 to 1854-5 inclusive.

Engineering Record, Volumes 9 to 1884 to Volume 35 to 1896 complete.

The books are in Toronto and any inquiry will be given full particulars at to bindings, condition, etc. Apply Box 21-A.

Canadian Market for British Steel Castings

A member of *The Institute* in England, is interested in an up-to-date company manufacturing steel castings, and would be glad to hear of firms requiring special steel castings. Box 22-A.

Patent Pipe Bend

The above bend, patented by L. McL. Hunter, Jr.E.I.C., city engineer's office, Ottawa, is being used in Ottawa for a catchbasin trap.

The old method was to use an ordinary quarter bend but these would not allow of the thawing out of the pipes. The bend had to be broken to get the nozzle of the thawing apparatus into the pipe.

With the above bend the thawing and flushing is very easily carried out. Also drain cleaning rods can be introduced to remove any blockage in the pipes.

The sole distributing agents for Canada are the T. S. Kirby Co., 213 Sussex St., Ottawa.

Meeting of Society of Chemistry Industry, Montreal

"Chemistry and the Motion Picture" formed the timely and popular subject of an intensely interesting lecture by Dr. C. E. K. Mees, of the laboratories of the Eastman Kodak Company, Rochester, N.Y., in speaking before the Montreal Section of the Society of Chemical Industry, Montreal, held at the Queen's Hotel, Monday the 20th of February.

The monthly meeting of the Society was preceded by the usual dinner, after which H. W. Matheson, the chairman, introduced the lecturer of the evening, Dr. Mees, who was given a very hearty reception. This was not the first time Dr. Mees spoke before the Society, he having been one of the visitors from the United States at the annual meeting of the Society of Chemical Industry held at McGill University last August, at which he gave a paper dealing with "The Preparation of Synthetic Organic Chemicals".

In dealing with the more popular subject, the making of the motion picture film, Dr. Mees illustrated his lecture with lantern slides which were most elucidating.

In part he said the development of the motion picture has depended upon improvements in the apparatus for taking and projecting the pictures and in the sensitive film on which the pictures are recorded. The manufacture of film starts with cotton, which, after washing and drying, is treated with a mixture of sulphuric and nitric acid until it has absorbed the right amount of nitric acid, as result of which it becomes soluable. After washing out the excess of acid, it is mixed with the solvents in large condensers, and stirred until completely dissolved The solution is then coated upon a wheel 20 feet in diameter, having a very smooth surface, from which the film is stripped as it is formed by the evaporation of the solvents. The sensitive emulsion is made by precipitating a solution of silver nitrate with bromide derived from the brine wells of Michigan, the silver nitrate being made by dissolving metallic silver in nitric acid. The making of motion picture films absorbes a significant proportion of the world's production of metallic silver. The precipitation of silver is carried out in the presence of gelletine, and the "emulsion" as it is called, is coated upon the film by dipping one side of the film passing over a roller into the melted emulsion. It is then chilled and sets as a jelly and is dried.

The film is slit to the exact width required for the motion picture, 1⅜ inches, and is perforated and packed up in rolls of 200 or 400 feet.

The film is of two kinds, the negative film, which is used for taking the pictures and which is extremely sensitive to light, and the positive film, on which the negatives are printed to produce the pictures projected in the motion picture theatres. The negative film is exposed in the camera in the motion picture studio or out of doors, and is then developed, usually by winding it upon a rack, which is then inserted in a tank of developer. The film, after fixing and washing, is dried on huge revolving wheels. The negative is examined and then printed on to the positive film in a printer so designed that the intensity or time of printing is automatically varied to compensate for changes in the density of the negative, and the positive film is in its turn developed, fixed, washed and dried. Positive films are then examined and joined together to make the continuous roll of film used in production, positives often being tinted with a dye or made of tinted base, or the image toned to some colour in order to produce various effects.

Besides the manufacturing, the chemistry of the motion picture deals with the nature of the emulsion and with the changes which go on in it when exposed to light, developed and fixed.

If a picture be examined under a high-power microscope, the image will be found to consist of tiny grains of black silver looking like masses of coke. These grains have in their turn been formed during development from the original silver grains of silver bromide, of which the emulsion was composed, which are crystalline in nature,

the effect of light action being to make the silver bromide more easily attacked by the developer, which transforms it into the black metallic silver. The silver bromide which was not affected by light and consequently not changed into silver by developer, is removed in the fixing bath, leaving only the black grains of metallic silver to form the final image.

Trade Publications

Wood Stave Pipe, published by the Pacific Coast Pipe Company Limited, 1551 Granville Street, Vancouver, B.C. This booklet deals with the history and applications of Wood Stave Pipe. It contains in addition to the above a number of useful tables.

Locomotives, published by Geo. D. Whitcomb Company, Rochelle, Ill. A series of bulletins dealing with the types of gasoline and electrical locomotives built by the Company.

Generator Cooling Apparatus. Bulletin 246, published by B. F. Sturtevant Company, Hyde Park, Boston, Mass. The different arrangements of Generator Cooling Apparatus are described and information given regarding fitments for various types of cooling apparatus.

Price Rathbun Stationary Oil Engines. Form 101020 published by Canadian Ingersoll-Rand Company, Limited, Sherbrooke, Que. The Price Rathbun Stationary Oil Engine is a semi-Diesel type; the features of the engine, its cycle of operation and applications, are outlined in a twenty-eight page booklet.

OBITUARIES

Robert A. Galbraith, A.M.E.I.C.

Robert A. Galbraith, A.M.E.I.C., after a long illness died on Dec. 29th. at his residence at Carleton Place, Ont. Mr. Galbraith was born at Ramsay, Ont. in 1860 and began his engineering experience as chainman and rodman on the Ottawa, Arnprior and Parry Sound Railway. He was promoted to assistant engineer on the same line and later moved to Northern Ontario where he played a prominent part in the development of that section of the Province. The last few years of his life was spent at Carleton Place, where he became well known. An athlete throughout his life, Mr. Galbraith was distinguished first in football and cricket, and later in curling; sportmanship was an outstanding characteristic. Mr. Galbraith is survived by his wife and one daughter. He was elected Associate Member of *The Institute* on Oct. 12th, 1899.

Captain A. G. Knight, S.E.I.C.

Captain A. G. Knight, D.S.O., M.C., S.E.I.C., is reported by Militia Headquarters, Ottawa, to have been listed as missing on December 20th, 1916, as no further information regarding Captain Knight has been received; it is presumed he died on or about that date.

Captain Knight was born at Bedford, England, in 1895 and was taking an engineering course at the University of Toronto when the war broke out, he was one of the first to enlist and had a distinguished career in the Royal Flying Corp before his untimely death. He was liked and respected by all who knew him in his "year" at Toronto and his loss among many "School Men" was most keenly felt. Captain Knight became a Student of *The Engineering Institute* in his freshman year, 1914.

Late A. E. B. HILL, M.E.I.C.

Engineering Legislation in U. S.

According to a circular issued by the American Association of Engineers, laws licensing engineers and architects who design and supervise the construction of buildings have been passed in the following states:—Arizona, Colorado, Florida, Indiana, Illinois, Iowa, Louisiana, Michigan, Minnesota, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Tennessee, Virginia, and West Virginia, in all, 17 states. Such laws are now before the legislatures of Kentucky, Mississippi, and South Carolina.

PERSONALS

S. J. Fisher, M.E.I.C., recently accepted a position with The E. B. Eddy Company, Limited, at Hull, Que.

H. S. Grove, A.M.E.I.C., is at present with the Ottawa Hydro-Electric Power Commission.

Geo. M. Hudson, A.M.E.I.C., has been appointed division plant engineer, The Bell Telephone Company of Canada, Montreal, Que.

B. B. Hogarth, A.M.E.I.C., inspecting engineer of the Dominion Water Power Branch, is at present on work connected with his departmen at Great Falls, Man.

F. P. Flett, Jr.E.I.C., is at present with the Trussed Concrete Steel Company of Canada, Limited, Walkerville, Ont.

E. R. WOODWARD, S.E.I.C.
Winner of Students' Prize 1921

G. R. Holmes, S.E.I.C., formerly of Nova Scotia Technical College, is now with Eagar, Coombs & Company, Limited, Halifax, N.S.

E. L. Pettingill, A.M.E.I.C., formerly of Copper Cliff, Ontario, has joined the staff of the Canadian Des Moines Steel Company, at Chatham, Ont.

C. E. Fraser, A.M.E.I.C., has served his connection with James Proctor and Redfern, Limited, consulting engineers to take the position of township engineer and road superintendent for Birch Cliff, Toronto, Ont.

J. A. Grant, A.M.E.I.C., formerly of St. John, N.B., has taken up residence in Montreal, with an office in the New Birks Building, under the firm name of J. A. Grant & Company, Limited, engineers and contractors.

E. M. Medlen, A.M.E.I.C., formerly structural draughtsman, Hamilton Bridge Company, Hamilton, Ont., is now with the Geodetic Survey of Canada, Department of the Interior, Ottawa, Ont.

David G. McKean, A.M.E.I.C., formerly with the Greater Winnipeg Water District, has become associated with the firm of McKean & Renwick, contractors, Glasgow, Scotland.

A. B. Cooper, M.E.I.C., formerly with the Canadian General Electric Company Limited, has been appointed general manager of the Ferranti Meter and Transformer Manufacturing Company Limited.

N. L. Somers, A.M.E.I.C., has sold out his interests in the firm of Reid and Somers Limited, engineers and contractors. Mr. Somers has not yet announced his future plans.

Walter J. Parker, S.E.I.C., vice-president of the Steward Construction Company Limited, has recently taken up his residence in Preston, Ont. Mr. Parker was formerly in Toronto.

E. L. M. Burns, R.C.E., Jr.E.I.C., has recently returned from the School of Military Engineering, Chatham, England, and is now stationed with the Officer's Mess, R.A. Park, Halifax, N.S.

D. M. Chadwick, A.M.E.I.C., formerly with the Maritime Bridge Company of New Glasgow, N.S., has been appointed sales engineer with the Canadian Bridge Company Limited, 510 New Birks Building, Montreal, Que.

R. L. DOBBIN, M.E.I.C.
Member of Council and first Secretary of the Peterborough Branch.

C. T. J. Laurendeau, S.E.I.C., B.Sc. A., graduate of Laval University, son of Judge Laurendeau of Montreal, has joined the sales staff of the MacKinnon Steel Company Limited, with office at 404 New Birks Building, Montreal, Que.

Brigadier General A. G. L. McNaughton, C.M.G., D.S.O., accompanied by Mrs. McNaughton, returned to Canada last month. He has resumed the duties of director of military training at Militia Headquarters, Ottawa, after having spent a year attending the Staff Course in England.

S. J. Fortin, M.E.I.C., has been appointed city surveyor for the City of Montreal. Mr. Fortin will have full charge of the "supervision of all streets, squares, highways, common sewers, and all other public works or places connected with his department; to make and have charge of all the levels, lines, surveys, measurements, sketches and plans of the city generally, or any part thereof, whenever required to do so; to examine and determine from time to time, whether any repairs or improvements may be necessary to any street, sidewalk, sewer, or other public work under his supervision". He has been with the City of Montreal for several years, and his promotion is well deserved.

Interesting Hydro-Electric Development.

A very interesting hydro-electric development work is in progress in Mexico, under the direction of G. R. G. Conway, M.E.I.C., now managing director of the Mexican Light and Power Company, and formerly chief engineer of the British Columbia Electric Railway Company, Vancouver, B.C. The load of the Mexican Light and Power Company has been creeping up enormously during the past three years, and is now about 420 million kilowatt hours per annum. This enormous growth of load has seriously handicapped the company and some time ago it was decided to proceed immediately with the development of a new plant below the existing Nacaxa plant, capable of generating about 40,000 additional horse power. This work is now in progress and involves the construction of a tunnel about 4½ kilometers in length, destined to carry about 27 cubic meters per second. The work is being forced rapidly ahead, and it is hoped to have the power available by March of 1923. The company is also developing a smaller plant to the south of Mexico in the State of Morelos, which will give about 25,000 horse power additional. Half of this will probably be available for use about next July.

T. W. Harvie, A.M.E.I.C., appointed as Chief Engineer of Montreal Harbour Commissioners.

T. W. Harvie, A.M.E.I.C., who has recently been appointed chief engineer for the Montreal Harbour Commissioners, is like many engineers a native of Scotland, where he spent his early days and received his technical education. Following experience as resident engineer with the Caledonian Railway Company, Mr. Harvie was engaged for three years in heavy railway construction and was later on the staff of the Clyde Navigation Trust. He served as resident engineer on various harbour works and later became engineer for Sir Robert McAlpine and Sons. In 1910 Mr. Harvie was appointed assistant engineer to the Montreal Harbour Commissioners and for three years was engineer on the construction of the Victoria Pier and the Market Basin, as well as the shore wharves and the upper section of the high level railway. Mr. Harvie has had twenty-five years experience in engineering, over twenty years of which have been spent exclusively in connection with harbour and dock works. He is, therefore, eminently fitted for his new and important position.

Resignation of Head of Montreal Water Board.

A. E. Doucet, M.E.I.C., who has resigned recently as head of the Montreal Water Board, was born in 1860 in the City of Montreal. He graduated from Royal Military College, Kingston, and following experience as rodman on construction of the Algoma branch of the Canadian Pacific Railway, he was appointed resident engineer on the Lake Superior Jackfish Bay line, in 1883.

A. E. DOUCET, M.E.I.C.

He was later appointed assistant engineer of the Lachine Bridge construction in 1886 and the year following was division engineer of the Canadian Pacific Railway at St. John's, Que. For three years from 1887 Mr. Doucet was chief engineer of construction for the contractors building the Algoma & Sault Ste. Marie Railway, the Cape Breton Railway and the Newfoundland Railway. For seventeen years beginning in 1898, Mr. Doucet was chief engineer in succession of the Arrowhead & Kootenay Railway, Quebec and Lake St. John and district engineer at Quebec for the N.T.R. Railway. In 1915 Mr Doucet engaged in private engineering practice. In 1918, he was appointed head of the Montreal City engineering department, and later was appointed head of the Montreal Water Board which has done notable work in connection with the aqueduct.

Mr. Doucet is a man of wide vision and many activities. He has been a member of *The Institute* since its foundation as The Canadian Society of Civil Engineers, he has acted on the Council and has been Chairman of the Quebec Branch. He has been interested ever since his college career in military affairs, and served with distinction during the North West Rebellion.

Resignation of F. W. Cowie, M.E.I.C., as Chief Engineer of Montreal Harbour Board.

After thirty-six years of continuous service in connection with the River St. Lawrence Ship Channel and the Harbour of Montreal, F. W. Cowie, M.E.I.C., has resigned from the position of chief engineer of the Harbour Commissioners, and has been appointed consulting engineer to the board.

Immediately after his graduation from McGill University in 1886, Mr. Cowie joined the staff of the Harbour Commissioners of Montreal under the late Sir John Kennedy, then chief engineer. For twenty years Mr. Cowie was directly connected with the River St. Lawrence Ship Channel, and became an authority on river hydraulics, dredging and improvements to navigation.

In 1907, when the Harbour Commission of Montreal was reorganized and the chief engineer, the late Sir John Kennedy, Hon.M.E.I.C., appointed consulting engineer, Mr. Cowie received the appointment of chief engineer.

For the last fifteen years, Mr. Cowie has been engineering head of the Harbour Commissioners, and his scheme of improvements, designed in 1909, and adopted by the commissioners after recommendation by a board of consultative engineers, is now about completed.

Few engineers have had the advantage of such experience as Mr. Cowie. He had the advantage of training and association with that great engineer, the late Sir John Kennedy. For the Government of Canada and the Commissioners of Montreal Harbour he has a record of accomplishments. His schemes were recognized as in the public interest and they went through.

In 1914 the Council of the Institution of Civil Engineers of London, England, awarded Mr. Cowie the coveted Telford gold medal for his paper on "The Transportation Problem in Canada and Montreal Harbour."

New Chairman, Ottawa Branch

K. M. CAMERON, M.E.I.C.

K. M. Cameron, M.E.I.C., the new Chairman for 1922 of the Ottawa Branch, was born at Strathroy, Ont., November 1st, 1880. Securing his preliminary education in the public schools of that place and the Collegiate Institute of Strathroy and London, he graduated from the Royal Military College in 1901 as silver medalist, and from McGill University, in 1903, as Master of Science in Civil Engineering. He has been connected with *The Engineering Institute of Canada* since 1901, when he was elected as Student. His engineering experience has been gained at the Canadian Niagara Power Company, at Niagara Falls, under the late C. B. Smith; on the Pennsylvania Railroad Tunnels, New York; on the construction of the hydro electric plant of the Bar Harbour and Union River Power Company, at Ellsworth, Maine; with the Ambursen Hydraulic Construction Company, in Wyoming, and the Department of Public Works of Canada. He entered the service of that Department in 1908 as principal assistant to the district engineer at London, Ont. was promoted to district engineer at Sherbrooke in 1911, and came to Ottawa in 1912 as assistant to the assistant chief engineer of the Department. When A. R. Dufresne, M.E.I.C., assistant chief engineer, left the Department in 1918, Mr. Cameron was promoted to succeed him. The position of assistant chief engineer of the Department of Public Works is one of the most important in the Dominion Public Service and during his tenure of office Mr. Cameron has shown outstanding ability both as an engineer and administrator.

Ottawa Branch has been fortunate in its choice of Chairman, and in electing Mr. Cameron the Branch is assured of continued energy and activity in the direction of its affairs.

Engineers Honour Mr. St. Laurent

Arthur T. St. Laurent, M.E.I.C., after a long and faithful career in the Public Works Department, has been promoted to the position of chief engineer of that department, a position carrying with it large responsibilities.

Members of the Ottawa Branch of *The Engineering Institute of Canada* at a special luncheon on February 15, evinced in a remarkable manner their approval of the appointment and the esteem in which they held him.

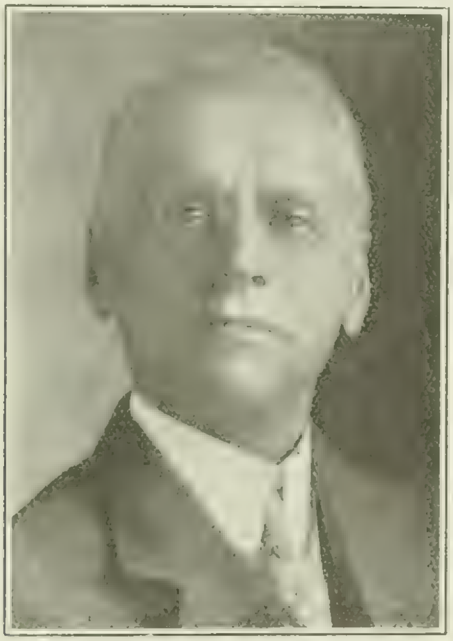
K. M. Cameron, M.E.I.C., Chairman of the Ottawa Branch, presided, and at the head table were many eminent engineers and others, among them being, in addition to the guest of honour, Premier Oliver, of British Columbia, J. B. Hunter, deputy minister, Department of Public Works; Clarence Jameson, Civil Service Commission; G. J. Desbarats, deputy minister, Department of Naval Affairs; George A. Mountain, chief engineer of the Board of Railway Commissioners, all of whom spoke.

Others seated at the head of the table were: D. R. Cameron, A.M.E.I.C., Kamloops, B.C.; H. B. R. Craig, M.E.I.C., London, Ont.; B. H. Fraser, M.E.I.C., chief engineer, Department of Marine; E. A. Cleveland, M.E.I.C., controller of water rights, B.C.; S. J. Chapleau, M.E.I.C., senior engineer, Public Works Department; W. J. Stewart, M.E.I.C., chief hydrographer, Naval Service; H. J. Lamb, M.E.I.C., supervising engineer, Public Works Department, Toronto; Col. W.P. Anderson, C.M.G., M.E.I.C., past president of *The Engineering Institute of Canada;* W. A. Bowden, M.E.I.C., chief engineer, Depart-

ment of Railways and Canals; J. B. McRae, M.E.I.C., consulting engineer; C. R. Coutlee, M.E.I.C., senior engineer, Public Works Department; R.F. Uniacke, M.E.I.C., chief engineer, Department of Justice; U. Valiquet, M.E.I.C., senior engineer, Public Works Department; S. Lelièvre, A. R. Decary, M.E.I.C., supervising engineer, Public Works Department, Quebec; G. Gordon Gale, M.E.I.C., Hull Electric Railway.

Tributes to Mr. St. Laurent, both as an engineer, and as a man, were finely paid by all the speakers. J. B. Hunter remarked that the esteem in which the guest of honour was held went far beyond the circle of government engineers, for he was as highly esteemed among engineers in private practice.

He built to stay, said Mr. Hunter,amid applause. He was a square peg in a square hole, with an emphasis on the square, for squareness was characteristic of the man. His staff was as intensely pleased as he himself when Mr. St. Laurent's appointment was announced.



ARTHUR T. ST. LAURENT, M.E.I.C.
Chief Engineer Federal Department of Public Works

Clarence Jamieson, of the Civil Service Commission, extended felicitation in the well-earned advancement of Mr. St. Laurent in the service. In doing so he made an announcement which emphasizes in a remarkable manner the brotherhood feeling which exists in *The Engineering Institute of Canada.* Mr. Jamieson said he would be betraying no secret now when he mentioned that Mr. Cameron, the chairman, who was in the direct line for promotion to the vacancy, had written the Civil Service Commission stating that he favoured the appointment of Mr. St. Laurent as one well merited and in the public interest. This intimation was cordially acclaimed, and Mr. Cameron, when he was able to secure a hearing, modestly remarked that he was sure every engineer present and similarly situated, and knowing Mr. St. Laurent as he did, would have done the same.

G. J. Desbarats, M.E.I.C., paid his respects in French as a tribute to the nationality of the guest of honour.

George Mountain, M.E.I.C., a past president of the Ottawa Branch, recalled Mr. St. Laurent's services to branch as a former member of the council, and as a past the vice-president of *The Institute,* and he suggested that the members should keep their guest of the day in mind when the time came for the presidency of *The Engineering Institute of Canada* to come to Ottawa.

Premier Oliver, of British Columbia, said engineers had done much in the advancement of Canada, and though there was a lull at the present time seemingly in Canada's development in that respect, he was sure there would still be great opportunities for the engineers of the future. He commented on the fact with pride that the new federal premier had chosen a member of the B.C. government to become minister of Public Works. Mr. Oliver remarked that he had been acquainted with Hon. J. King for nearly 20 years, and he was absolutely incapable of a mean action.

Mr. St. Laurent was loudly applauded on rising to reply to the many felicitations. He was delightfully reminiscent, and caused much laughter by the detailing of some of his early struggles and experiences. He thought he had had a good streak of luck in life and proceeded to demonstrate how, in various crises this element had apparently favoured him. He paid tribute to the "good wife" with whom he had been favoured, and who, he said, was an ideal companion for life, also to his two good boys and two good girls, "no matter if I do say if myself," he added amid laughter and applause. He thanked many present, who, he said, had befriended him in various times.

Referring to the action of the Chairman, K. M. Cameron, to which Mr. Jamieson had called attention, Mr. St. Laurent said he thought there was nothing more noble than this. He could imagine no better evidence of a fine spirit towards a confrere. Mr. St. Laurent said he wished to express to them all his deep gratitude for their expressions and token of esteem. He thought congratulations were due to *The Institute,* that it was one of its members which had been promoted, which augured well for its future recognition.

Mr. St. Laurent was born at Rimouski, Quebec, in 1859. He graduated from the Ecole Polytechnique, Montreal in 1885, and for three years was engaged on the location and construction of the Temiscouata railway. In 1888 he entered the Civil Service and was appointed assistant district engineer at Winnipeg. Returning to Ottawa in 1898 he designed the lock and dam at St. Andrews, on the Red river, north of Winnipeg, and in 1902 constructed the Laurier avenue bridge at Ottawa and the government grain elevator at Montreal.

The engineering features of the investigation into the feasibility of the Georgian Bay canal by the Commission appointed for that purpose was entrusted to Mr. St. Laurent.

In 1908, on the completion of the latter work, Mr. St. Laurent was appointed assistant deputy minister of the Public Works Department, since which time he has been connected with many extensive projects dealing with navigation and harbour and dry dock construction.

With the formation of the Dominion Power Board, Mr. St. Laurent was made vice-chairman. He is a member of *The Engineering Institute of Canada*, of which he was vice-president for three years, also of the American Society of Civil Engineers, the International Congress of Navigation, and is the technical representative chosen by the deputy ministers as a member of the Federal Civil Service board of hearing and recommendation. Mr. St. Laurent was chairman of the Ottawa section of *The Engineering Institute* in 1914.

As successor to E. D. Lafleur, M.E.I.C., recently deceased, Mr. St. Laurent will assume the responsibility for the engineering work of the Public Works Department. This is one of the larger spending branches of the government, and one whose work extends to every point in Canada where Federal public works are carried on. Coming under his supervision is a large staff of capable engineers, who have long worked with him and these confreres with his extensive circle of friends both inside and outside of the civil service will congratulate Mr. St. Laurent upon his well-merited appointment.

BRANCH NEWS

Victoria Branch

H. M. Bigwood, A.M.E.I.C., Secretary-Treasurer.

Manufacture of Coal Gas

On the 6th of February, a paper on "The History and Progress of the Manufacture of Coal Gas" was given by F. J. Kennedy, of the West Gas Improvement Company. The paper was well illustrated by excellent lantern slides.

As a new plant to manufacture gas by the Glover West system of continuous vertical retorts has recently been erected in Victoria, the lecture was of particular interest and resulted in a good attendance.

The history of gas manufacture, from Murdock's time to the present was traced, and the process to be used locally fully described as to operation and recovery of by-products. That the method now adopted is founded on most recent practice was shewn by the fact that over 40 new plants on similar design were in course of erection at various places. Montreal and Vancouver both have such plants in operation.

The meeting was held in the auditorium of the Victoria Chamber of Commerce of which body the Victoria Branch is now a member, and is represented by H. M. Bigwood, A.M.E.I.C., Secretary of the Branch.

It is hoped that by its affiliation with the one organization which is most closely in touch with the business life of the community and also the southern part of Vancouver Island, that both the public and the engineering profession will benefit. It will place at the disposal of the Chamber, and through it, the public, the technical ability and national strength of *The Institute*, while it will bring to the attention of everyone the willingness and ability of the engineers as a professional body to take part in the public life of the community.

Meeting of Association of Professional Engineers

In order that the benefits expected from legislation may be more closely felt, and also in order that the large number of members of the Association of Professional Engineers, residing in or near Victoria, may take a more active part in the administration of the act, a branch of the association, to be known as the Vancouver Island Branch of the association was brought into existance recently at a meeting of local members.

A provisional committee was chosen to conduct the business incidental to the formation of the branch, consisting of E. E. Brydone-Jack, M.E.I.C., (Chairman), P. Philip, A.M.E.I.C., (Chairman of the Victoria Branch, E.I.C.), J. P. Forde, M.E.I.C., H. M. Bigwood, A.M.E.I.C., Secretary, E. N. Horsey, A.M.E.I.C., and ex-officio H. L. Johnston, M.E.I.C., and Geo. Wilkinson, local members of the Council of the Association.

Reception and Dance

On Friday evening, the 24th of February, the Branch will hold a Reception and Dance, to which all members of the profession have been invited. It is to be an extension of the principle under which the lunches have been held and which have brought many members as yet outside the membership of *The Institute* into closer touch with the ideals and aspirations of the national society.

Future Programme

Several papers and visits have been arranged for the immediate future:—

March 8th, F. G. Aldous, A.M.E.I.C., paper on "A surveying expedition into Syria-Damascus to Aleppo—following the British occupation", with lantern slides.

At later dates, paper on "Esquimalt Dry Dock" to be followed by a visit to the work. Paper on "Dredging and River bank protection", by J. P. Forde, M.E.I.C., district engineer for the Public Works Dept. of Canada, and a visit to the new plant of the Victoria Gas Company.

Vancouver Branch

P. H. Buchan, A.M.E.I.C., Secretary-Treasurer.

Meeting of B.C.T.A.

A very personal problem is facing the professional engineers of British Columbia, personal because it touches their pocket-books, in that the multiplicity of fees to the various associations is becoming a burden of no small proportions in these hard times. Common determination to try and alleviate this condition of affairs culminated in a meeting open to all concerned, to discuss the admisability of eliminating at least one of the existing societies — the one named being the British Columbia Technical Association.

The B. C. T. A. was originally called into being for the purpose of providing a body common to engineers and technical men of every branch, which would undertake the work involved in getting a professional act passed in the B. C. Legislature, legalizing the registration of engineers in the Province. Coupled with this main object, was the promotion of mutual fellowship and good-will

among the members of these various branches, and concerted action to increase the remuneration of engineers generally.

Owing to the existence of a body specially formed to administer the act, to which all qualified to practise must belong, it has been felt that the B. C. Technical Association has outlined its usefulness, and should be dissolved. Here, however, a complication arises, in that approximately one hundred of its members have not the qualifications requisite to registration under the act, and it has been arged by many of their more fortunate fellow-members, that the B. C. T. A. should be held together for the benefit of these non-professional technical men. Further, it is widely believed that this body provides a common instrument for dealing with the welfare of engineers generally, in ways which are not within the scope of other engineering organizations.

A large number of those present at the meeting called on February 7th, took part in the discussion, among whom were Mr. Wootton, President of the B. C. T. A., who reviewed the history and objects of his association, and Mr. Brakenridge, Chairman of the Vancouver Branch of the *E.I.C.*, who outlined the scope of *The Institute's* activities as a possible substitute for the B. C. T. A. All the points brought up were carefully discussed, and viewed from numerous angles, so that the opinion expressed by the meeting can be taken as the result of mature consideration of the question.

It was finally moved by W. Brand Young, A.M.E.I.C., and seconded by A. S. Wootton "That it is desirable in the opinion of this meeting that the British Columbia Technical Association continue to function". On a show of hands 18 declared in favour of continuance, 24 declared against. The Chairman declared the motion defeated.

It was then moved by W. G. Swan, M.E.I.C., seconded by W. H. Powell, M.E.I.C., "That this meeting goes on record recommending that an organization be formed along the lines of a General Engineering Council composed of delegates appointed from existing organizations, — to function when concerted action in the interests of all engineers is needed". This motion was carried.

The profession is now awaiting the action of the B. C. Technical Association, and the other engineering bodies concerned in the last resolution.

Visit to Vancouver Gas Plant

Through the kindness of the Vancouver Gas Company, the members of the Vancouver Branch spent an unusually intresting afternoon at the new gas-works on Keefer St., on Saturday 11th February.

This plant is the only one of its kind on the Pacific Coast and the third in Canada, and has been in course of erection for the past eighteen months, having been formally opened by the general-manager, George Kidd, only one month ago. It was designed and built by the West Gas Improvement Company of Manchester, Eng., and embodies the most modern features of economical manufacture of gas and its by-products. The plant has a capacity of one million cubic feet per day, and cost a half-million dollars. The design and construction of foundations, housing, bunkers, etc., has been in charge of A. J. Waters, M.E.I.C., who has been specially employed by the Vancouver Gas Company, as resident engineer.

J. Keillor, gas engineer, and his staff of experts did everything in their power to make the visit an interesting one. Owing to the large number present, which included many student engineers from the University of British Columbia, there were three parties organized, the guides being Messrs. Draeper and Brown of the gas company's engineering staff, and Mr. Punnett of the West Gas Improvement Company. Every part of both the new and old plants were inspected, and the guides were kept fully occupied in answering the steady fire of questions from their interested visitors.

After the inspection, the various parties assembled in the exhauster room, where cigars and very substantial refreshments were served through the kindness of the Vancouver Gas Company. In proposing a vote of thanks, Mr. Brakenridge, Chairman of the Branch, stated that Mr. Keillor was preparing a paper on the plant, which he had very kindly consented to read before a general meeting of the Branch in the near future.

City Tax for Engineers

A recent amendment of the charter of the City of Vancouver has given the City the right to license all professional men practising within its boundaries, irrespective of licenses paid to the Provincial Government. Considerable stir occurred in professional circles recently when the City Council announced the scale of fees it proposed to demand. Deputations at once waited on the Council to present the views and objections of the various professional bodies.

Mr. Brakenridge, Chairman of the Vancouver Branch, appeared in behalf of the engineering profession and although he was not successful in reducing the fee, he did succeed in conjunction with the other bodies, in obtaining the promise of the City Council to have the word "tax" substituted for the word "license", thereby relieving the fundamental objection of professional engineers, that the word "license" would favour evasion of the Professional Engineer's Act, by allowing non-registered parties to practise under protection of the City.

The fee for engineers is $25.00 per annum, to be paid by every engineer engaged in private practice within the City. In the case of a firm with two or more partners, each member pays an individual fee. The profession considers the tax a hardship on the younger members, whose business and clientele are not as extensive as older established firms.

"Toike-Oike" Meeting

The Pacific Coast Branch of the University of Toronto Engineering Alumni Association held its fifty annual dinner in the University Club, Vancouver, on Saturday evening, 28th January. About thirty-five of the eighty-odd members of the Branch were presents including a number from Victoria, New Westminster and Seattle, — a very good turnout considering the way "School men" are scattered up and down the Coast.

The old "School" spirit of camaraderie pernaded the gathering from the outset, and everyone thoroughly enjoyed not only the solid and *liquid* refreshments, but

the songs, choruses, and yells which livened the proceedings. The President of the Branch, W. J. Johnston, A.M.E.I.C., discharged the duties of chairman and toastmaster, the guest of honour being J. H. Kennedy, M.E.I.C., who has the distinction of being the oldest living graduate of S. P. S., and the honorary-president of the Branch.

A very substantial contribution to the merriment of the evening was made by the President "Guiness" Johnston who wrote a song to the tune of "Solomon Levi", featuring W. G. Swan, C. E. Webb, G. P. Stirret and others. The chorus, which was sung with great enthusiasm, led by an excellent quartette, ran as follows:

CHORUS: *"Solomon Levi"*

Oh Engineers, hip, hip, hip, hurrah;
[Oh Engineers, hip, hip, hip, hurrah!
For we're the boys that face the world
[with hearts so light and free,
We're busy morning, noon and night,
[so keen for work are we,
We build the mighty railroads,
[the boats and buildings high,
When there's no work for us to do,
[we'll all lie down and die.

The menu was a departure from the usual formal card, being arranged in the form of a programme for a two-act play, the cover bearing this inscription: "The Engineering Alumni of the University of Toronto, Pacific Coast Branch, in their fifth annual presentation, a revival of the grand "old school" comedy "Toike Oike" in two acts, etc. The menu was blue-printed from a Vandyke negative and tied with gold ribbon, thus combining the "school" colors, blue, gold and white most effectively. The details of the management, cast, etc., aroused no little amusement.

The Branch, though not very strong numerically, has acquired quite a reputation in university circles on the Coast as an active organization. Last summer, it had the honour of entertaining the past president of *The Institute*, J. M. R. Fairbairn, M.E.I.C., at a luncheon in the Hotel Vancouver. Mr. Fairbairn is a fellow "School man" and a very enthusiastic number of the U. of T. Engineering Alumni Association in Eastern Canada. The Pacific Coast Branch has the following members of *The Institute* on its roll:—Members: J. H. Kennedy, W. G. Swan, W. A. Clement, A. L. McCulloch. Assoc. Members: C. E. Cooper, C. T. Hamilton, E. A. Jamieson, W. J. Johnston, R. G. Swan, G. P. Stirrett, E. L. Tait, C. E. Webb, J. A. Walker, A. P. Augustine, D. A. Graham, N. C. Stewart, E. L. Burgess, H. D. Fyfe, P. H. Buchan, W. L. Stamford, N. C. Sherman.

Calgary Branch

Arthur L. Ford, M.E.I.C., Secretary-Treasurer.
Floyd K. Beach, A.M.E.I.C., Branch News Editor.

On Friday, January 27th, at a luncheon in the Hudson Bay Company's tapestry room, the Calgary Branch of *The Institute* and the Alberta Military Institute joined in listening to Dr. R. W. Boyle, dean of the faculty of science and professor of physics at the University of Alberta, in a very interesting address on Rainmaking.

The address was of a popular nature, and was of great interest to everyone living in an arid or semi-arid country where imposters at times endeavour to take advantage of the credulity of the public. The text of his address will appear in an early number of *The Journal*.

In the evening of the same day, Dr. Boyle addressed the Calgary Branch on an electrical subject. There was a good turnout of members and a number of electrical men were guests of the Branch on this occasion.

Convention of Western Association of Building and Contracting Industries.

The Western Association of Building and Contracting Industries met for a two day convention in Calgary, February 14th and 15th. The convention discussed the problems of the various industries represented, looking toward early revival in the building trades, and ended with a banquet very well arranged and followed by an excellent musical programme and after dinner speeches.

The convention was made up of a large number of visitors from Manitoba, Saskatchewan and from other parts of Alberta. An invitation was extended to members of *The Institute*, and a large number of them availed themselves of the opportunity so courteously offered.

Among the members of *The Institute* prominent in the work of the convention were V. A. Newhall, A.M.E.I.C., manager of the local branch of Trussed Concrete Steel Company, who was chairman of the committee on prices of materials, and F. E. Emery, A.M.E.I.C., Alberta representative of the Manitoba Bridge & Iron Works Limited.

Edmonton Branch

R. H. Douglas, A.M.E.I.C., Secretary-Treasurer.

The regular monthly meeting of the Edmonton Branch of *The Engineering Institute of Canada* was held in the Edmonton Board of Trade rooms on Wednesday, January 18th, 1922. The meeting took the form of three 15 minute papers on subjects of local interest, each paper being followed by a 15 minute discussion.

A. W. Haddow, A.M.E.I.C., Edmonton city engineer, gave a brief outline of the organization and workings of the various city services from an engineering standpoint. He also gave a description of the experiments that had been carried on in connection with cinder walks using various types of binder.

Edgar Stansfield, M.E.I.C., of the Industrial Research Department, at the University of Alberta, gave a short account of the work of the Lignite Utilization Board of Canada. In the fifteen minutes allotted to him, he outlined the gradual evolution from small scale laboratory experiments on lignite carbonization, commenced five years ago in Ottawa, to the commercial carbonizers now installed at Bienfait, Saskatchewan. The problems of briquetting were only referred to incidentally. In the discussion which followed, some economic questions of lignite carbonization and briquetting were considered, including the extent to which the work of the Board would assist in solving Alberta's problems. In view of

the high cost of purchased binders, the speaker suggested a type of self-contained plant, in which only part of the product would be briquetted, as one which might succeed in the Province.

In a brief address, Mr. Donaldson, A.M.E.I.C., outlined the route, conditions of grades, economic and social possibilities of the Jasper Highway, proposed to be constructed through the utilization of the portions of railway track abandoned between Evansburg and Hinton where connection would require to be made with Dominion Government roads through Jasper Park to Jasper.

The claims of Edson and its tributary communities for road connection with Edmonton were voiced, the Park as an objective, being for the present, the only justification for progress beyond Edson. Engineers were called upon to interest themselves in this project so that public discussion and action may be based upon a sane realization of the construction requirements of this important work.

The three essentials for consideration and action in this matter are: —

1. The utilization of the beauties and holiday resources of our Dominion Jasper Park now inaccessible, except by rail.

2. The profitable economic consequences to Edmonton, and the area to the West consequent upon a highway being constructed.

3. And lastly, the necessity for securing some return for the enormous outlays in these railways from which constructions, neither income nor service is now derived.

Lethbridge Branch

C. M. Arnold, M.E.I.C., Secretary-Treasurer.

On January 14th, the Lethbridge Branch held a dinner at the Y.M.C.A., at which were present 50 corporate members and affiliates of the Branch. S. G. Porter, M.E.I.C., occupied the chair. At the close of the dinner popular songs were sung and some of the members gave songs and violin solos.

H. B. Muckleston, M.E.I.C., read a paper entitled "Actuarial Factors in the Design of Irrigation Structures", which has been sent to the *Journal.*

The Chairman announced that the Branch membership at present was as follows: 7 members, 23 associate members, 3 juniors, and 17 affiliates of the Branch. This includes applicants recommended for election by this Branch.

On January 28th, the Branch held another general meeting and dinner at the Y.M.C.A., at which 45 were present. S. G. Porter, M.E.I.C., in the chair. After a short musical program, G. N. Houston, M.E.I.C., gave an address on the "Manufacture of Smokeless Powder and the Construction of the Plant at Nitro, W.Va., U.S.A., The address was fully illustrated by lantern slides, and was very interesting to all. At the close of the address discussion followed, and the number of questions asked was evidence of the interest taken in the subject.

On February 11th, the members of the Branch again gathered for a general meeting and dinner at the Y.M.C.A., the number present being 37, this attendance being smaller on account of severe cold weather. As an indication of the interest shown it may be mentioned that one member walked six miles to the train, and another rode a saddle horse three miles in weather 25 below zero, to attend this meeting, both repeating the trip at 2.30 in the morning on the return.

G. N. Houston, M.E.I.C., occupied the chair, in the absence of the Chairman, S. G. Porter, M.E.I.C. C. D. MacKintosh, A.M.E.I.C., addressed the meeting, the subject being "The Evolution of Transportation". The speaker began with the history of the initial development of transportation — passing on to the phases of railway reconnaissance, location and construction, and closing the address with a number of personal reminiscences which led to a general discussion and further reminiscences from a number of those present.

Winnipeg Branch

Geo. L. Guy, M.E.I.C., Secretary-Treasurer.

Welding

At a meeting of the Branch held in the University Buildings on the 2nd February, E. P. Fetherstonhaugh, M.E.I.C., in the chair, two papers on Electric and Oxy-acetylene Welding were read. The electrical paper was read by J. M. F. Wilson, A.M.E.I.C., and the oxy-acetylyne paper by Mr. Brown of the Liquid Air Company.

Mr. Wilson covered the field of electric welding very completely, dealing with both the theoretical aspects and the practical application, and discussed very fully the different methods and equipment at present in use. He pointed out that electric welding had now got to the stage where it was being systematically investigated and he hoped in the near future that definite rules and practice would be evolved which would do away with many of the different methods at present in use, claims for which were not always based on accurate engineering knowledge.

A very live discussion on the papers took place, which was contributed to by several gentlemen who were actively engaged in the welding field. The discussion brought out the very pronounced differences of opinion which are at present held on the merits of the different methods of welding and some of the speakers did not hesitate to claim the superiority of the methods which they were familiar with, although from a general view of the discussion it was obvious that all methods at present in use had their particular field.

The Chairman tendered the congratulations of the Branch to J. G. Sullivan, M.E.I.C., on his selection to presidency of the Institute

It was decided to appoint a Committee to look after the interests of the engineering profession in view of the proposed Income Tax and other tax bills at present before the local Legislature.

Illumination

A meeting of the Branch was held at the University Buildings on the 16th February, E. P. Fetherstonhaugh, M.E.I.C., in the chair.

A paper was read by Professor Fetherstonhaugh on the measurement and calculation of illumination. The paper was illustrated by diagrams, and the speaker very fully discussed the calculation and measurement of

illumination, both on a theoretical and practical basis. By means of different types of photometers, the actual measurement of illumination was clearly shown, and the advantages of the different types of instruments were explained. At the close of the paper, an active discussion took place, in which many points were brought out of interest to the members. The question of proper illuminating codes was also discussed.

Among the business for the evening, was a report from the Committee who were instructed to co-operate with the Citizens Committee in protecting against the provincial income tax. The chairman reported progress, stating that the Committee had attended the general meeting of protest held in the Board of Trade building, and that a sub-committee had been appointed representing the various interests in the city, one of the members of *The Institute* having been placed on this Committee. The report was received and adopted, and on a motion the Committee were instructed to co-operate with the General Committee of Citizens in every way possible to promote the effective administration of the Province and the reduction of capital and operating expenditure in the near future. This motion brought up a vigourous discussion, during which active criticism was made, both for and against the motion. The motion eventually carried by a large majority.

Members of the Branch were invited to attend a moving picture exhibition under the auspices of the C. O. T. C., showing the work of the air force in Canada. A large number of members attended and were well repaid by the interesting nature of the pictures.

A notice of motion was given that at the next meeting a committee should be appointed to fully consider the question of the province, taking over its natural resources and particularly to investigate the position of the Province with respect to its water power resources, with a view to leaving these resources in the control of the Federal Government, on account of the able and efficient manner in which the water power of the province had been administered and investigated by the Water Power Branch of the Dominion Government.

Border Cities Branch

J. Clark Keith, A.M.E.I.C., Secretary-Treasurer.

The regular monthly meeting of the Border Cities Branch was held in the Cadillac Cafe on Friday the 10th inst. at 7 o'clock, twenty members being present.

J. E. Porter, A.M.E.I.C., reported for J. J. Newman, M.E.I.C., Ontario Provincial Division Representative, on the progress being made toward the securing of legislation for engineers in Ontario at the present session of the Legislature.

J. Clark Keith, A.M.E.I.C., briefly stated what had been accomplished at the meeting of Branch Secretaries held in Montreal, at the time of the Annual Meeting. The detailed report of the meeting was still in the hands of the executive and it would be brought to the attention of the Branch at an early meeting.

L. McGill Allen, A.M.E.I.C., gave a very interesting address on "The Placing of Concrete under Various Conditions". He dealt with the developments in the placing of concrete from the time of the old mixing board to present day efficient mechanical equipment. The relative merits of and objections to the spouting system were discussed with relation to economy in handling coupled with the nature of the structure on which the concrete was being placed. The methods of placing concrete under water were handled in detail as a result of the speaker's personal experience on dams at Sherbrooke and Murray Bay, Que., the general method being followed of allowing the concrete to flow from one end of the form to the other, and not by being deposited in layers along the full length of the form. The construction of an addition to the Ford Motor Company's plant in water varying in depth from 13 to 20 feet was of particular local interest.

The paper produced much desirable discussion, and almost every member gave his personal experience. D. A. Molitor, M.E.I.C., explained the construction of the walls of the Toronto Harbour Commission, stating that although monolithic construction was opposed by the contractor on the ground that inferior work would result, actual results showed it to be superior to block construction. Doubt was also expressed during the construction of the Sault Ste. Marie locks as to the under water concrete but it proved on laboratory test to be superior to that laid above. W. H. Baltzell, M.E.I.C., related his experiences with slow setting concrete and blast furnace clay. Laboratory tests were shown to be entirely unreliable in some special instances, but the value of such tests was fully appreciated.

A hearty vote of thanks was tendered the speaker for his address, resulting as it had done, in so much general information being elicited.

Niagara Peninsula Branch

Rex P. Johnson, A.M.E.I.C., Secretary-Treasurer.

The January dinner meeting was held at the Welland Hotel, St. Catharines, on the 18th of the month, with an attendance of only twenty-four.

In the absence of the Branch Chairman, on a business trip to the Western States and California, the Vice-Chairman, F. S. Lazier, M.E.I.C., presided. Mr. Lazier gave a short outline of some of the recent work of the Executive Committee, and the Branch representative on the Executive of the Ontario Provincial Division, presented a verbal report on a recent meeting of the Division which had to do with process and recent developments in legislation. In this connection, the Branch was advised that certain opposition had developed among the mining communities in Northern Ontario, and an explanation of the means taken to meet this opposition and its possible effects, were announced to the meeting.

Messrs. A. Milne, M.E.I.C., and W. H. Sullivan, M.E.I.C., advised that they had each interviewed respectively Messrs. Greenlaw, M.P.P. of St. Catharines and Cooper, M.P.P. of Welland, in regard to the "Act Respecting Professional Engineers" which is to again come before the forthcoming session of the Ontario Legislature. It developed that Mr. Greenlaw is very much opposed to the Bill, and that Mr. Cooper was reticent and non-committal regarding his views on it.

The business part of the meeting was followed by an interesting, illustrated talk by J. W. Purcell, A.M.E.I.C., on the subject of "Rural Power Distribution in Ontario from the Hydro Lines". The speaker gave the members a very thorough and comprehensive idea of the uses of electric power on the farm and explained the methods of application, difficulties of distribution, cost data and power rates, and the nature and extent of preliminary studies and educational work necessary to constructing a rural line.

The February meeting of the Branch was held on the 15th of the month, at the Lafayette Hotel, Niagara Falls, Ontario, with an attendance of forty. The mayor and city council, and the Chairman of the town planning committee were present as guests of the Branch, and members of the Rotary Club were present. After enjoying a very good dinner, followed by a lusty use of the song sheets and a brief report by the Secretary on the recent meeting of Eastern Branch Secretaries at Montreal, the Chairman introduced H. L. Seymour, A.M.E.I.C., whose subject was "Town Planning with particular reference to Niagara Falls and Vicinity". The speaker outlined recent progress in this subject and showed that a large number of Ontario towns and cities are actively engaged on planning work. Legislation governing municipal control of lands, buildings and property was outlined, and the speaker then described, with lantern views, many details and phases of his subject in different places and the application of town planning principles to Niagara Falls. A hearty vote of thanks was tendered to the speaker at the close of his address.

Messrs. Acres, Blanchard and Johnson attended the Annual and Professional meeting of *The Institute* in Montreal on January 24-26. Vice-President Acres conducted the business session on the afternoon of the first day, and addressed a very large meeting of the Montreal Branch on the evening of the third day. His subject was "The Queenston-Chippawa Power Development", illustrated with slides and motion pictures.

Councillor Blanchard addressed the Kingston Branch on the same subject, the day before the Annual Meeting.

The Branch Secretary attended an all day conference of Eastern Branch Secretaries, held coincident with the Annual Meeting. This meeting is a new feature of *Institute* activities, and resulted in much benefit to those in attendance, and will be of material benefit to all the Branches represented.

A meeting of the Executive of the Ontario Provincial Division was held coincident with the Annual Meeting. This Branch was well represented by the attendance of the above mentioned three members.

The Branch Chairman has returned from a business trip to the Western States and California in connection with a number of water power developments.

Hamilton Branch

W. F. McLaren, M.E.I.C., Secretary-Treasurer.

A meeting was held in the Royal Connaught Hotel, 27th. January 1922, to hear an address by T. H. Hogg, A.M.E.I.C., asst. hydraulic engineer with the Hydro-Electric Power Commission of Ontario, on the proposed St. Lawrence River Power Development.

Mr. Hogg stated that while navigation of rivers in Canada came under the jurisdiction of the Dominion Government, the power rights belong to the province and it was for this reason that the Hydro-Electric Power Commission, representing the people of Ontario through the provincial government, had offered schemes for power development to the International Joint Commission. About 1912 the Hydro-Electric Power Commission commenced making observations of river level and flow and later carried out extensive surveys and diamond drill borings, and were therefore in a position to present a complete proposition based on thorough study.

The deep waterways scheme naturally divides itself into three zones. Two of these, from Montreal Harbour to Lake St. Louis and from Lake St. Louis to lake St. Francis are entirely within the Province of Quebec. The third, from Lake St. Francis to Lake Ontario is the International reach of the river between Ontario and the State of New York. It is only with this third section that the Hydro-Electric Power Commission deals in its proposals for power development.

The fall from Lake Ontario to Lake St. Francis at Cornwall is 92 feet, of which 84 feet may be used for power. From Cornwall to Montreal there is a fall of 134 feet, making a total fall from Lake Ontario to Montreal of 226 feet, of which about 180 feet is available for power development. About four million horse-power may be developed from the St. Lawrence as compared with three million from Niagara, the difference being due to the necessity of preserving the Falls.

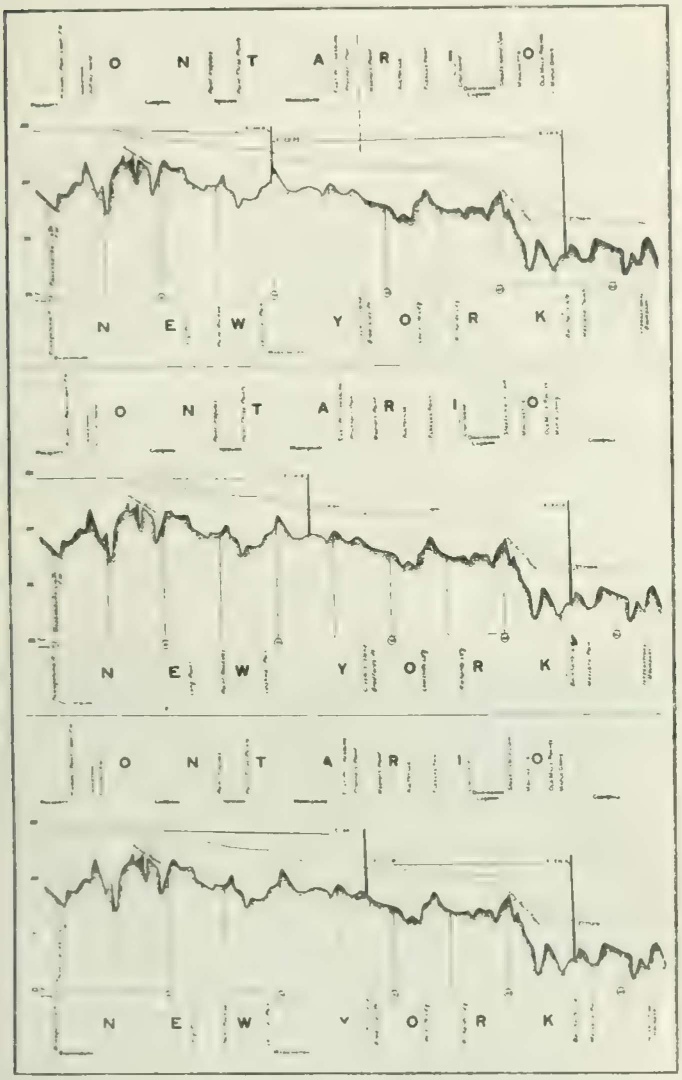
By treaty Canada has the right to use 36,000 cu. ft. per second for power development on the Niagara river and the United States 20,000. New development under construction on the American side will require an additional 10,000 cu. ft. per second and altogether to supply present developments and those under construction 84,000 to 94,000 will be required out of an available 100,000 to 110,000 cu. ft. per sec. The complete permissible development is thus being approached at Niagara Falls.

One of the great advantages of the St. Lawrence river for power development purposes is its uniformity of flow, which varies from 320,000 to 190,000 cu. ft. per second, a ratio of less than 2 to 1. This low ratio is very striking when compared with other large rivers on the continent, as, for example, the Ottawa with a ratio of maximum to minimum flow of 25 to 1, the Columbia 27 to 1, and the Susquehanna 200 to 1.

The so-called Super-Power Zone, which extends along the Atlantic Seaboard from Portsmouth, N.H. to Washington, D.C., and about 150 miles inland uses 9,000,000 H.P. and is adding 275,000 H.P. each year by steam engines. This district will provide a market for surplus power from the St. Lawrence. New York City is 300 miles from the proposed development, the same distance as Hamilton, an economic transmission distance in consideration of the other available sources of energy for the district, and the cost of development and transmission. Transformation and transmission of power for a distance of 300 miles in blocks of 100,000 H.P. costs about as much as the production of the power at the power site. Power costing $15.00 per H.P. per year at the development would cost about $30 per H.P. year at New York or Hamilton. It is quite possible that eventually Lake

Ontario will be completely encircled by transmission lines connecting the existing systems and joining the two primary sources of power on the Niagara and St. Lawrence.

It will be possible to develop 1½ to 2 million H.P. on the International reach of the St. Lawrence and thus save 35,000,000 tons of coal per annum, half of this being for the benefit of Canada and half the United States. The present Canadian Plants at Niagara develop 425,000 H.P. and the Queenston Development brings this up to 1,000,000 H.P.



Scheme A of the Hydro-electric Power Commisson of Ontario; would flood 29,000 acres valuable land.

Scheme B—A two stage development with many advantages.

Scheme C—Another two stage development but open to many objections.

The Hydro-Electric Power Commission in its report on the St. Lawrence Development suggests three schemes for power development. Scheme A. is a single development by a dam at Barnhart Island above Cornwall, where an effective head of 74½ feet may be used. Scheme B. is a two stage development with power dams at Morrisburg and Barnhart Island, the head at the former being 28 feet and at the latter 54 feet. Scheme C. is a modification of Scheme B, the upper dam being located at Crysler Island about five miles downstream from Morrisburg.

By Scheme A, 1,500,000 H.P. could be developed and by Schemes B. and C, 1,600,000 H.P.; The cost per H.P. of the initial portions of these developments varying from $124 to $127 per H.P. Thirty thousand acres of land would be affected by flooding in Scheme A. and 6,000 and 11,000 respectively by B. and C. The cost of the complete development would be $60,000,000 for the navigation works and $150,000,000 for power, a total of $210,000,000.

In Scheme B. the initial development would consist of 600,000 H.P. developed at the upper dam from units of 10,000 H.P. capacity each, running at 100 r.p.m., installed in a power house nearly a mile long; a little more than half of this would be on the Canadian side to compensate for water taken by the Chicago Drainage Canal. At the lower dam where 1,000,000 H.P. would be developed units of 25,000 H.P. each, at 100 r.p.m., are proposed.

A 30 ft. depth is proposed for the navigation channels. In Lloyd's Register for 1918-19 over 80% of the steamships listed had drafts of 25 feet or less, and over 99% draw 30 feet or less. A 30 ft. draft would accommodate all ocean going vessels except the large modern liners.

The accompanying river sections show the 3 schemes submitted. The first is very similar to that proposed by the government engineers while the 2 stage developments are very similar to that proposed by the New York and Ontario Power Company.

The address was illustrated by slides.

Following the address, the paper was discussed by Messrs. W. S. Connolly, H. B. Dwight and F. W. Paulin. It was brought out in the discussion that the high speed of units could be obtained with a new type of waterwheel recently designed. This type has a very high runaway speed, namely 150% above normal. It is estimated however, that this would only improve an increase of 15% in cost of generators which is more than offset by the reduction in size of unit, due to the higher operating speed.

A hearty vote of thanks closed a most instructive evening, with an attendance of about 100. The chair was occupied by E. H. Darling, M.E.I.C., who announced that the next meeting would be on 16th February, when Prof. Durley would address the Branch on Standardization. Prof. Durley has recently returned from Europe where he studied industrial conditions.

Toronto Branch

F. B. Geodike, M.E.I.C., Secretary-Treasurer.
C. R. Young, M.E.I.C., Branch News Editor.

Incineration

At the meeting held on January 26, the subject of Incineration was discussed in an illustrated address by R. R. Knight, M.E.I.C., engineer and manager for Francis Hankin & Co., Ltd., Toronto.

Mr. Knight outlined the various types of incinerators and destructors used for the disposal of garbage, pointing out the relative advantage of each. The most suitable type of equipment was that which utilized the fuel value of the garbage itself to carry out the destruction. An average of about one-fifth of a ton of garbage per capita per annum may be assumed from a large community, and since one pound of garbage may be considered as capable of evaporating a pound of water in addition to the three-quarters of a pound present in the garbage, the heat value of this material is evident. Mr. Knight stated that it possessed about one-quarter of the calorific value of a poor coal.

According to the speaker, the commercial utilization of the various constituents of garbage was impracticable for cities of less than one-half million in population. Similarly the destruction of garbage by incineration was not feasible without the use of added fuel for cities of less than 15,000 population.

Previous to the address, J. M. Oxley, M.E.I.C., made a formal motion for certain amendments to the by-laws of which he had given notice at the previous regular meeting.

Ashburnham Bridge, Peterboro

On account of the illness of S. R. Cound, of the Baldwins Canadian Steel Corporation, he was unable to give his address on February 2, on the plant of that company, as provided in the program. In his stead, Frank Barber, M.E.I.C., gave an illustrated address on the new Ashburnham Bridge, Peterboroo. This is a reinforced structure containing the longest arch span in Canada. C. J. Townsend, A.M.E.I.C., of the Russel Townsend Construction Co., who were the contractors for the bridge, also contributed to the discussion.

At the meeting of the Executive held on the same evening, the Secretary was requested to write the city authorities asking that all street names be illuminated.

It was also decided that a letter be sent to various prominent engineers in this district, urging them to exert their influence with local members to secure the passage of the Professional Engineers' bill, now before the legislature.

Fertilizers

R. W. Perry, of Gunn's, Ltd., not being able to give his address on "Side Lights on the Packing House Industry", on February 9, H. G. Bell, of the Canadian Fertilizers Association, kindly addressed the Branch on "Fertilizers". He pointed out the various valuable constituents of these materials, and traced their effect on the crops. The commercial importance of replenishing the soil was graphically stressed by Mr. Bell.

John T. Farmer, M.E.I.C., Vice-Chairman of the Montreal Branch, was present at the meeting, and conveyed the greetings of that Branch to the Toronto members. He was requested to convey to the Montreal Branch similar greetings from Toronto.

Rail-Carbon Steel

At the meeting of February 16, the Branch heard a very valuable illustrated address by J. B. Carswell, A.M.E.I.C., president of the Carswell Construction Company, Ltd., on "Rail-Carbon Steel".

Mr. Carswell traced, at some length, the origin and quality of the steel from which rail-carbon steel bars are manufactured. He pointed out that steel rails are normally manufactured from a high quality of material, and that there is small likelihood of defective material being used from this source for reinforcement bars. He stated that the average age of the rails now being employed for such manufacture is about eleven years.

The use of a material somewhat higher in carbon than structural grade was defended by Mr. Carswell on the ground that there is a great cushioning effect in the concrete, so that little shock is applied to the bars He thought that it was entirely practicable to take advantage of the higher elastic limit of such material.

So rigid is the inspection of the materials purchased for reinforcement bar manufacture, that there is little likelihood of defective material being used. Even more effective, said the speaker, is the automatic test that arises when a rail with a piped head is led into the rolls. The head will open out and jam in the guides, so that the whole process comes to a standstill until the rolls can be cleaned and re-set.

Mr. Carswell pointed out that rail-carbon steel has been used successfully on the Panama Canal, the shiplock at New Orleans, the Parliament Buildings, Ottawa, the large terminal elevator, at Port Arthur, and in many other structures.

J. M. Oxley, M.E.I.C., in opening the discussion, pointed out that sometimes large quantities of rails are rejected because of high phosphorus content or other defects, and wished to know if there might not be a danger of such material being manufactured into reinforcement bars. He asked if cracks which occurred in this material might not elude inspection, and later in the structure cause a breakdown.

Wm. Storrie, M.E.I.C., asked if there were any appreciable difference in the strength of bars rolled from the head, the web, or the flange of the rail.

T. D. Mylrea, A.M.E.I.C., pointed out that even with high carbon steel the shock attending the punching of holes in concrete ships did not break the steel rods. He thought that the cushioning effect of the concrete was an important protective agency against the breakage of brittle steel.

R. O. Wynne-Roberts, M.E.I.C., wished to know concerning the influence of the growing tendency to use open hearth steel in rail manufacture.

O. W. Ellis, Department of Metallurgy, University of Toronto, pointed out that segregation was most likely to occur at the base of the rail head and hence bars rolled from the head would more likely be defective than those rolled from other portions of the rail.

Mr. Carswell, in reply to the comments, stated that it was possible for a large purchaser to select the particular class of rail from which his reinforcement bars would be rolled, although this would add to the cost. He regretted that the economic situation during the war had resulted in the rolling of some material from munition discard steel. However, this no longer was possible. He thought that one test for each ten tons of material was scarcely enough. The highest ultimate strength, disclosed in a series of 90 tests cited by Mr. Carswell, was 109,000 lb. per sq. in.,

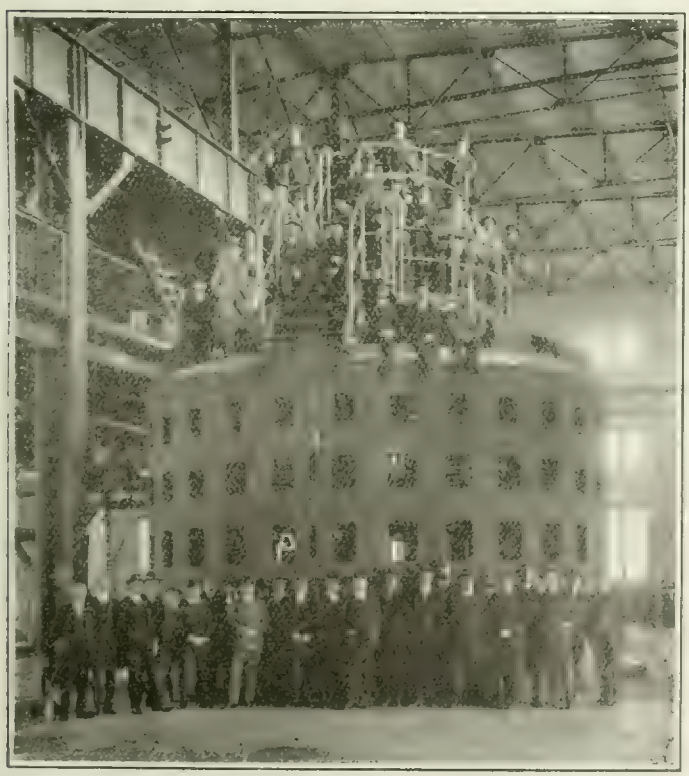
and the lowest 51,000 lb. per sq. in. Probably 90 per cent. of the tests ran from 55,000 to 75,000 lb. per sq. in. The larger bars showed lesser strength to the extent of 7 or 8 per cent. and consequently the manufacturers do not roll bars as a rule higher than 1¼ inch. Mr. Carswell stated that the use of open hearth steel for rails constituted in no sense the criticism of rail carbon steel reinforcement.

Peterborough Branch

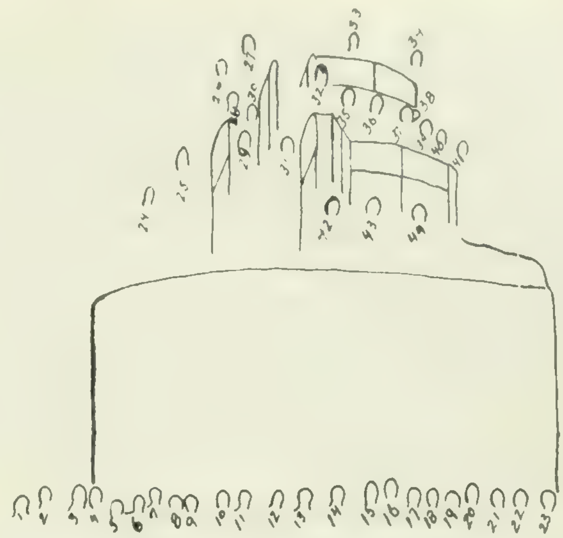
D. L. McLaren, A.M.E.I.C., Secretary-Treasurer.

Visit to Canadian General Electric Company's Plant

Through the courtesy of our fellow member E. G. Patterson, general superintendent of the Canadian General Electric Co., the members of the local Branch paid a visit to the factory of the C. G. E. Co., and inspected one of the ATB-16-45000-187½-12000 volt generators which are being built for the Queenston plant of the Hydro-Electric Power Commission of Ontario. This development is being watched with interest by engineers throughout the continent. Below is given a picture of the machine as assembled in the factory. The picture is interesting to engineers in view of the fact that after the machine is installed, only that part of the machine from the stairway up will be visible. This, of course, is due to the type of power house construction.



Peterborough Branch Visit to Canadian General Electric Work.



Key

1	F. H. Dobbin	24	F. E. Kerr
2	P. L. Allison	25	Jas. Mackintosh
3	L. Potvin	26	A. A. Richardson
5	E. Maybee	27	E. R. Shirley
7	J. Anderson	28	Robt. Hall
8	J. Lang	29	A. B. Gates
9	W. H. Pretty	30	R. C. Flitton
10	G. B. Smith, Belleville	31	W. M. Cruthers
		32	H. O. Fiske
11	H. A. Fife	33	B. L. Barns (A. C. engineer, C. G. E. Co.)
12	A. L. Killaly		
13	E. G. Patterson	34	E. H. Mason
14	R. H. Parsons	35	A. Roberts
15	P. P. Westbye	36	R. Hinton
16	Geo. Coutts	37	Barry Ottewell
17	R. B. Rogers	38	W. J. Perks
18	Alan Munro	39	Heber Rogers
19	Ross Dobbin	40	H. J. Rogers
20	John Barnes	41	Sefroy Goulet
21	A. W. Logan	42	Geo. Henderson
22	V. S. Foster	43	W. J. Wren
23	M. N. Clark	44	P. Manning

Silent Knight Engine

On January 26th, a very interesting address was given by J. R. Marlow, general sales manager of Willys-Overland, Toronto, on the "Silent Knight Engine".

The speaker traced the development of the Knight engine from the time of Mr. Knight's earliest experiments in 1902-03, when he evolved the idea of an internal combustion engine which would be silent in operation as compared to the generally used variety of popper or mushroom valve type, up to the present well known "Silent Knight Engine", with its unparallel performance record.

The first engine was built about 1903, and wonderful results obtained. It was not, however, until Mr. Knight's association in 1908, with the Daimler Motor Car Co., of Coventry, England, that any real progress was made. The gruelling tests made at that time under Mr. Knight's

supervision are now matters of history, and have never been even attempted by any other engine manufacturers. Two engines were placed on the test blocks and run for six days continuous with wide open throttle. Each was then placed in a chassis and run for over 2000 miles on the track at an average speed of over 42 miles per hour After that, the engines were again placed on the test blocks, and run for another six days continuous, and as characteristic of the Knight, found to be delivering more power at the end of the run than at the start. The engines were then pulled down for examination and found to be remarkably clean and free from carbon, and to exhibit scarcely any traces of wear.

At the close of the address, two rolls of film were shown. These were obtained by P. P. Westbye, through the courtesy of the C.P.R., and were entitled: "A Party at the Top of the World", and "Discovery of the French River". These were beautiful scenic views and much appreciated.

The Construction of Permanent Highways

The regular meeting for the month of February, was held on the 9th of the month. H. S. Van Scoyoc, of the Canada Cement Company, Montreal, and formerly chief engineer of the Toronto-Hamilton Highway, gave an address on "The Construction of Permanent Highways".

The speaker discussed road construction and stressed the importance of permanent construction. He dwelt on the success of the Hamilton Highway, and he pointed out that while the first cost had been far greater than macadam, the upkeep of macadam was many times greater. Concrete paved roads paid for themselves, he declared. The average cost of maintenance of concrete roadway on the highway in 1921, was about $72.00 a mile, while the macadam would cost about $6,500.

Motion picture films were used to illustrate the address. The latest types of construction machinery were shown in operation, and the Hamilton Highway was viewed from airplane and automobile, and the development along it clearly shown.

Kingston Branch

L. T. Rutledge, M.E.I.C., Secretary-Treasurer.

A regular meeting of the Kingston Branch was held on January 10th, at which Col. Anderson, of the Royal Military College, Kingston, gave an address on the work of the Imperial Staff College, London, England. The Staff College is an army officers' college, at which many officers from all parts of the British Empire attend, to be instructed in the science of modern warfare. One of the great benefits as pointed out by the speaker, is the fact that it brings together from all over the world, men whose views may be quite divergent and it serves as one of the bonds of unity for the Empire.

The next meeting was held on January 23rd, at which meeting A. C. D. Blanchard, M.E.I.C., gave an interesting and instructive lecture on the "Queenston-Chippawa Development", recently completed. The paper was illustrated with numerous slides which showed the construction work in all its stages. Mr. Blanchard, who was a field engineer on the work from the beginning, showed himself to be well acquainted with every detail of the big job, and he indeed brought the canal right to us. In fact, when shown every important detail in the gradual development by such excellent slides, it seems that more can be learned from such a discussion than if a hurried visit was made to the ground itself. The Branch is very much indebted to Mr. Blanchard for his excellent lecture, and the discussion that he aroused.

The last regular meeting was held on February 14th, when Col. J. Schmidlin, director of civil engineering at the Royal Military College, gave an illustrated lecture on "Aerial Surveying". Colonel Schmidlin traced the developments of aerial surveying by means of photography from a time previous to the advent of the aeroplane. The speaker then proceeded with a history of the improvement in cameras for this class of work. He stated that cameras of from 10 to 12 inches focal length are considered the best for photography from great heights. The cameras in use at the present time are almost automatic in action, and one roll of film admits of approximately one hundred photographs being taken with one loading of the camera. The speaker then dealt with the effect of varying altitude, with the variations in elevation of the ground surface and tilting of the camera due to the motion of the moving aeroplane. It was quite clearly pointed out that almost every aerial photograph was a distorted view of the true ground surface, being due to the fact that the photograph is a projection on a plane not parallel to the true horizontal plane. To remove the distortion various methods are employed. The more common method of doing this is by a geometrical or graphical method, using three points whose location and distance apart on the ground are known. A map is constructed from many photographs which overlap one another when taken. These photographs are cut to size and pieced together to form a map which is called a mosaic.

Aerial photographs of country covered with forest are not very clearly cut views. Trees cast shadows and it is difficult to distinguish the shadow from the object. It is commonly imagined that aerial surveying is the only method of surveying vast tracks of any unexplored country in Canada, but as these tracts of land are usually covered with trees, it is apparent that such a method does not prove itself as being the best method. However, aerial surveying of lakes and rivers give very accurate outlines. If the land to be surveyed is covered with many lakes and rivers, aerial surveying was pointed out to be an efficient and cheap method of doing the work.

Colonel Schmidlin outlined what has been done in Canada in aerial photography. He very carefully outlined the probable future of it. A very interesting discussion followed his lecture.

The Kingston Branch wish to report that its membership has lately been increased by approximately 90 new members, the majority of whom are student members.

Ottawa Branch

F. C. C. Lynch, Associate E.I.C., Secretary-Treasurer.

Engineers' Ball

Under the distinguished patronage of Their Excellencies the Governor-General and the Lady Byng of Vimy, Ottawa Branch entertained on the evening of January 26th, at the Chateau Laurier, at a charmingly arranged ball. Mr. and Mrs. K. M. Cameron, Mr. and Mrs. G. A.

Mountain, Mr. and Mrs. Gordon Grant, and Mr. and Mrs. J. B. McRae, received the guests at the entrance of the foyer. Each hostess wore a corsage bouquet of roses and violets, the gifts of the members of the committee.

A splendid orchestra provided lilting music for the dancing. Some of the guests played bridge in the Tudor room, and the banquet hall was used as a smoking room and for the serving of fruit punch. Supper was at 11.30 downstairs. The tables were daintily adorned with spring flowers.

Those who made the arrangements for this enjoyable event were J. B. McRae, M.E.I.C., O. S. Finnie, M.E.I.C., Philip Sherrin, J. L. Rannie, Col. A. F. Duguid, Commander C. P. Edwards, M.E.I.C., K. M. Cameron, M.E.I.C., assistant chief engineer of the Public Works Department, was chairman of this committee.

Among guests from out-of-town were J. M. R. Fairbairn, D.Sc., M.E.I.C., of Montreal, last year's president and Mrs. Fairbairn, Mr. and Mrs. Amyot, of Montreal, Mr. and Mrs. Gibault, of Quebec, Mr. and Mrs. J. M. Wilson, Mr. and Mrs. Cousens, Mr. and Mrs. Roy Millar, all of Toronto; M. J. Murphy, A.M.E.I.C., of Moncton, N.B.; Mr. Hal McGiverin, K.C., M.P., and Mrs. McGiverin, Mr. E. R. E. Chevrier, M.P., and Mrs. Chevrier, and Mr. and Mrs. A. E. Fripp, Senator and Mrs. Bostock, were also among the guests.

Local News

Among the members of the Ottawa Branch who attended the Annual Meeting at Montreal, were Messrs. K. M. Cameron, J. B. Challies, T. H. G. Clunn, M. F. Cochrane, A. A. Dion, G. B. Dodge, C. P. Edwards, O. S. Finnie, G. G. Gale, A. B. Lambe, F. C. C. Lynch, D. W. McLachlan, G. A. Mountain, N. J. Ogilvie, E. Viens, W. C. Way.

Thomas E. McGrail has been elected an associate member of *The Institute*, and Major D. L. McKeand an associate. S. D. Fawcett and R. M. Stenhouse have been transferred from juniors to associate members of *The Institute.*

The Battle of Jutland

A record attendance featured the luncheon on February 10th, at which the chief speaker was paymaster Commander W. H. Eves, R.N., who dealt in a graphic manner with the famous battle of Jutland. Commander Eves went through the battle in H.M.S. Royal Oak, super-dreadnought, and in his capacity as officer in charge of her coding office, was in intimate touch with the development and progress of the battle. His address was listened to with rapt attention, and was admirably illustrated by large charts showing the various dispositions of the rival fleets.

K. M. Cameron, M.E.I.C., Chairman of the Branch, presided, and seated at the head table with the chairman and guests of honour were, among others: Major-General J. H. McBrien, Brig.-Gen. McNaughton, G. J. Desbarats, C.M.G., Hamnet P. Hill, M.P.P., Col. W. P. Anderson, C. H. Keefer, Commander C. P. Edwards, C. A. Magrath, Hugo Craig, Captain Hose, G. A. Mountain, Admiral Sir Charles Kingsmill, J. B. Challies, and G. B. Dodge.

Commander Eves referred to some of the criticisms that had been levelled both at Admiral Jellicoe and Admiral Beatty with regard to their tactics. He remarked, however, that their decisions had to be lightning ones, and he caused some laughter when he remarked that, unlike some of their critics, they did not have time to sit down and smoke a pipe while arriving at a decision as to the best thing to do under the rapid and continually changing conditions. Jellicoe's deployment needed no justification from him he said; the testimony of the German commander, Admiral von Scheer, was sufficient. Jellicoe had threatened his whole line he said, with the result that the German admiral turned tail and ran for it, or, as the text books described it, he "made a strategic retreat to the rear", said the commander, amid considerable laughter.

As regards Beatty's alleged impetuosity, Commander Eves quoted, in refutation, from Beatty's own despatch where the admiral said: "I did not consider it desirable or proper to engage the enemy in the night."

The speaker said that night and bad visibility robbed Jellicoe of full victory, but the only time after that the German fleet ventured out to sea was to follow a single British cruiser and to surrender to Admiral Beatty.

Dominion Land Surveyors' Annual Meeting

The Dominion Land Surveyors' Association was organized in 1882, and since that time has received the full support of the Dominion Land Surveyors throughout Canada. The present Dominion Land Surveyors' Association is a reorganization of the old association, which took place in 1907. The purposes of the association have, however, been continued throughout.

The annual meeting was held at Ottawa on February 1 and 2, and was opened with an able address by the President, G. H. Blanchet, A.M.E.I.C. The Secretary-Treasurer, W. L. MacIlquhan, submitted a very satisfactory financial statement and report. On January 1, 1922, the membership was 227. M. D. McCloskey, read a report on "Land Settlement"; W. M. Dennis, A.M.E.I.C., reported on recent progress in geodetic surveying, and G. H. Herriot, M.E.I.C., reported the progress made in town planning in Canada in 1921.

Capt. Forster, of the Parks Branch of the Department of the Interior, delivered an address on "Our National Parks", followed by Hoyes Lloyd, M.A., also of the Parks Branch, with an interesting talk on "Bird Sanctuaries".

Purely technical papers were presented by L. T. Bowes, of the Naval Service of Canada, on "Hydrographical Surveying and its application in James Bay", and by M. P. Bridgland, of the Topographical Surveys Branch of the Department of the Interior, on "Phototopographic Surveying". Mr. Bridgland exhibited some of the finest lantern slides of mountain scenery ever seen in Ottawa. F. V. Seibert, A.M.E.I.C., Topographical Surveys Branch, gave a talk on "A Trip from Peace River to the Fort Norman Oil-fields", illustrated by many fine slides.

The closing address was given by J. A. Wilson, A.M.E.I.C., Secretary of the Air Board, and covered in a very complete manner the work of the Air Board in

Canada. The annual luncheon was held at the Chateau Laurier, 125 being seated. Hon. Charles Stewart, Minister of the Interior, Dr. E. Deville, Commissioner of Surveys, and Hon. Dr. Roche, chairman of the Civil Service Commission, were the speakers.

The election of officers for 1922, resulted as follows: president, G. H. Henriot, M.E.I.C., Winnipeg; vice-president, D. H. Nelles, M.E.I.C. Ottawa; secretary-treasurer, W. L. MacIlquham, Ottawa; councillors for Ottawa; J. W. Pierce, B. H. Segre, A.M.E.I.C. A. M. Perry, J. E. R. Ross, A.M.E.I.C., T. H. G. Clunn, A.M.E.I.C.; councillors for Ontario: E. P. Bowman, A.M.E.I.C., (West Montrose), F. W. Beatty, (Pembroke); councillors for Quebec and the Maritime Provinces: E. F. Gorman, (Buckingham); councillors for Manitoba, W. E. Hobbs, A.M.E.I.C., (Winnipeg), C. E. Joslyn, A.M.E.I.C., (Winnipeg); councillors for Saskatchewan: W. M. Stewart, A.M.E.I.C., (Saskatoon), W. R. Reilly, (Regina); councillors for Alberta: H. E. Pearson, (Edmonton), J. B. Alexander, (Calgary); councillors for British Columbia: J. E. Umbach, (Victoria), E. C. Coursier, (Revelstoke).

Ontario's Government Roads Programme

The Victoria Memorial Museum auditorium was filled on the evening of February 16th, when, under the auspices of the Ottawa Branch of *The Engineering Institute of Canada*, George Hogarth, O.L.S., M.E.I.C., of Toronto, chief engineer of the department of public highways of Ontario, delivered a most interesting address on "Our Public Highways". The lecture was illustrated by lantern slides as well as two moving picture films, and dwelt on the course of roadbuilding in Ontario from the revival of five years ago to the present time.

Two announcements of interest to Ottawa were made during the course of the lecture, one that the Ottawa-Prescott highway would be permanently surfaced from the city limits to Hog's Back, a distance of over two miles, and a second that the missing two miles of pavement on the Ottawa-Point Fortune road, a few miles out of Ottawa, will be built in the early part of the coming summer.

K. M. Cameron, M.E.I.C., Chairman of the Ottawa Branch of *The Institute*, introduced the lecturer, who pointed out that the development of the motor car created the necessity for good roads, and these developed with the development of motor vehicles. He outlined the various types of roads in Ontario. There was, first, the township road, of various types. Some of these had been taken over by the county as county roads. Some near cities had been taken over by suburban road commissions. On such as were still township roads the government paid 20 per cent. towards the cost. The roads were usually of earth and gravel and were frequently narrow, as they did not represent main travelled thoroughfares. Of the total township roads of a few years ago the Ontario counties had now assumed about 15 per cent. as county roads. On these latter the government paid 40 per cent. of the rebuilding and maintenance. Then there was the still higher type of county provincial roads which were constructed of a variety of materials from earth and gravel to concrete. On these the province paid 60 per cent.

Suburban roads commission had come into existence to look after the roads leading into a city, and 40 per cent. of the cost was contributed by the government, 30 by the city in question, and 30 per cent. by the county. The city and county jointly appointed the commissioners and the roads they constructed were usually of the permanent class.

At the conclusion of the lecture, two films were shown by the courtesy of the Department of Trade and Commerce. One was taken at various points on the Ottawa-Prescott highway, and the other was taken partly from motor car and partly from airplane on the Toronto-Hamilton highway, and was known as the "Silver Trail".

A. W. Campbell, M.E.I.C., Dominion commissioner of good roads, moved a vote of thanks to the lecturer for his interesting address.

Montreal Branch

J. L. Busfield, A.M.E.I.C., Secretary-Treasurer.

Chippawa Power Development

The first meeting after the Annual and Professional Meeting was held on Thursday evening, January 26th, at which H. G. Acres, M.E.I.C., gave a most interesting illustrated talk on the Queenston-Chippawa Power Development. The attendance was so great that many were unable to find even standing room in the hall. The author gave a technical description of the structure and construction proceedure in the work on the canal, the building of the power houses, and installation of the power plants. The address was followed by a series of motion pictures which were extremely interesting. The chair was occupied by J. A. Duchastel, M.E.I.C., chairman of the Branch.

Automotive and General Lubrication

On Thursday evening, February 2nd, W. C. Common, general manager of the Sun Oil Company, gave an address dealing with Automotive and General Lubrication from a technical point of view, following which there was an excellent discussion. E. J. Turley, A.M.E.I.C., presided.

Water Softening

On Thursday evening, February 9th, C. E. Hogarth, A.M.E.I.C., discussed the principles of water softening, with F. A. Combe, M.E.I.C., presiding. The speaker gave a brief outline of how all natural waters originate in rain, but in passing over the ground they gather impurities in the form of suspended matter and dissolved salts. The former is usually removed by filtration, the rapid sand filter being the most satisfactory and economical in most industrial plants — which gives a clear sparkling water free from all visible impurities.

Hardness in water, mostly lime, although dissolved and invisible, is the cause of the largest waste in manufacturing plants using natural untreated waters. This hardness is the cause of scale in the tea kettle or boiler, and the curd which forms when soap or soda is added to hard water.

The removal of this hardness or the softening of water in Canada in the past has usually been done by adding chemicals such as soda to the water. This method, although improving the water, never produced a water of zero hardness and, consequently, the best results cannot be obtained; the cost is high and requires expert supervision to get even good results.

The most satisfactory method now used for softening water is by the use of zeolite. In this method the zeolite mineral is held in a steel container, and the water filtered through it; the lime or hardness remaining with the mineral and the water passes from the bottom of the container perfectly soft. By this method a water of zero hardness is always assured.

Mr. Hogarth showed some interesting slides showing the process of the natural zeolite from the time it is mined until it is ready for commercial use, and also actual samples of the mineral in its natural state and after refining.

South American Railways

On Thursday evening, February 16th, H. K. Wicksteed, M.E.I.C., of the Canadian National Railways, reviewed the history of the South American Continent, with particular reference to the development of railways.

The first stretch of railroad in Brazil was all 5 ft. 3 ins. gauge, similar to that adopted in Argentina at the time; the conditions there warranted the use of the wide gauge tracks, whereas it was different in this section of Brazil. This was the first serious mistake made by the Brazilians in connection with the development of their railroads, but they very soon realized their error, and as a result, at the present time 60% of all railroads in Brazil were narrow gauge. This suited their conditions admirably, because of the fact that their average hauls were as yet within 300 miles, and also because of the limited capital available when the enterprise was first undertaken.

Another remarkable feature of the Brazilian railroads was that large culverts were practically non-existent. This in a country of tropical rainstorms and impermeable soil was made possible only by following the watersheds between streams wherever possible. Where a great valley cut across the country, heavy grades in conjunction with 20 percent curves solved the problem. Gravel or sand ballast was practically unknown, rock ballast only beginning to be used in the best roads, but sparingly.

Mr. Wicksteed mentioned the development of a new port and a new railway entrance to finally link up with a port on the Carribbean Sea. This would furnish a means of developing the rich mines and utilize to great advantage the vast grazing lands, fertile country and other natural resources in South America. The Southern continent was also rich in water powers which would permit of economical electrification of the country in the future.

In closing, Mr. Wicksteed spoke of the trade possibilities between the South American countries and Canada. Canada had already a foothold in Brazil, owning and operating the tramway systems of most of the large cities, the electric lighting systems, telephone plants and other industries. In view of these facts there was no reason why Canada should not trade with Brazil more extensively, each country having as exports some of the necessities of the other. Furthermore the Canadian engineer was playing an important part in the development of almost every South American country.

P. B. Motley, M.E.I.C., engineer of bridges of the Canadian Pacific Railway, presided.

Prizes to Students

Preceding the speaker of the evening, there took place a presentation of prizes to students for the best papers during the year ending June 1921. The presentation was made by Walter J. Francis, M.E.I.C., Vice-President of *The Institute* on behalf of President J. G. Sullivan. The prizes were in the form of cheques, one presented to A. Murray Robertson, S.E.I.C., for his paper on "The Organization of the Engineer Service during the War". Mr. Francis introduced the author, giving an outline of his overseas service in the Canadian Engineers, during which he was awarded the M.C., and twice wounded. Mr. Robertson is now in the engineering department of the Bell Telephone Company.

The other prize was donated to E. R. Woodward, Jr.E.I.C., for his paper on "The Coal Briquetting Plant at Bienfait, Sask." Mr. Woodward first became interested in this subject when he was overseas with the 1st Tunnelling Company, and in order to follow up Canadian practice he went to Saskatchewan at his own expense and worked for the Lignite Utilization Board in many capacities from a laborer to a laboratory assistant. As a result of his studies he wrote the paper which won him this prize.

Branch Secretaries' Meeting

At the commencement of the meeting, the Branch Secretary, J. L. Busfield, A.M.E.I.C., gave a short address on the results of the Branch Secretaries Meeting, an account of which is given elsewhere in this issue of *The Journal*.

Quebec Branch

Hector Cimon, A.M.E.I.C., Secretary-Treasurer.

Aircraft and the Possibilities of its Use by Engineers

An evening meeting was held on the 30th of January in the Green Room of the Chateau Frontenac, which was very well attended by local members and some friends. Chairman A. R. Décary, M.E.I.C., presided and introduced R. H. Nisbet, forest engineer, in charge of the aviation service of the firm of Price Brothers & Company, Limited.

Mr. Nisbet gave an interesting talk on aerial photography in connection with mapping. He said that there were many objections to so-called aerial surveys, and that accurate maps of large tracts of country could only be obtained from aerial photographs with the aid of a proper system of ground controls. The engineer on the ground is still and will remain the chief; he must direct the work of the airman; the pilot's duty in the air is complete when he flies his machine correctly in the course required, maintaining an even keel and constant height.

He elucidated the technicalities of the aerial camera and described the French, German and American cameras used for air photography. Photographs are taken at a height of 5,000 feet, 10,000 or even 15,000 feet, depending

on the type of camera used and some 300 exposures can be automatically taken in one hour. The speed of the aeroplane can be maintained at 100 miles an hour, so that the photographs taken in that time cover an area of several hundred square miles on the ground. Over 1,000 photographs were taken in a day by Mr. Nisbet's assistants, last summer.

There are certain errors in an aerial photograph which render extremely accurate survey difficult and, while they do not render accurate work impossible, they materially increase the cost owing to the work entailed in rectifying the photographs before the information they contain can be transferred to map form.

There are various claims made for and against the aeroplane for purposes of survey; the speaker feels certain, however, that in the not too distant future, it will be common practice in this country for an aeroplane, working as an adjunct of the engineer, to carry out the most accurate work, and that, with the aid of the aeroplane, the less known areas of our vast country will be surveyed at a pace hitherto impossible.

As to the cost of flying, including the use of an efficient machine, with pilot, mechanic, fuel, oil, depreciation and interest on the capital involved, accepting the life of a machine as 3 years, it may vary from sixty to eighty dollars an hour. If the photographic personnel and equipment is added to this, the cost may run up to $140 per hour. The great disadvantage of flying in this country, as far as costs are concerned, is the necessity for paying wages for a year during which there is only six months flying, and like everything else, the more the aeroplane is used, the less, proportionately, will be the cost per flying hour.

Mr. Nisbet concluded in saying that aviation is good enough to stand on its merits, and it will go ahead and develop in spite of the fact that it is not cheap.

A number of lantern slides were next placed on the screen, showing areas which had been photographed from the air, and useful explanations and comments were made by the speaker.

This was followed by a very interesting exhibit of moving pictures, showing the work of logging during the Winter months in the woods, the floating of the logs down the rivers to the mills, and the manufacture of newsprint by the firm of Price Brothers and Company, Limited, to whom the members of this Branch are much indebted for the courtesy with which they were given an opportunity to see that valuable film.

At the close of this exhibit, E. A. Evans, M.E.I.C., moved a vote of thanks to the lecturer, which was cheerfully carried.

The Scope of Engineer in Forest Industries

This was the subject of a most interesting address given by S. L. deCarteret, Esq., A.M.E.I.C., manager of the Lands Dept., for the firm The Brown Corporation, before the members of this Branch, at the monthly luncheon-meeting, which took place at the Chateau Frontenac, on the 13th of February.

Chairman A. R. Décary, M.E.I.C., presided the meeting, and introduced the speaker who, on rising, thanked his fellow engineers for their applause, and jokingly remarked that he was sure of it now, even if there should be none when he finished. He said that, in choosing his subject, he had in mind the pulp and paper industry but that his remarks will apply equally to the lumber industry.

More than 100 pulp and paper mills are in operation in Canada, and these have a total capacity of about 2,300,000 tons annually. These mills represent a capital investment of more than 350 million dollars, and they employ in excess of 32,000 persons, in addition to many more thousands engaged in the woods' operations.

The Province of Quebec has over 45 pulp and paper mills, representing a capital investment of more than 175 million dollars, and whose combined capacity is in the neighbourhood of 4,000 tons per day, which is about 50% of Canada's entire pulp and paper production.

This, then, is the field. What is the engineer's relation to it?

Mr. deCarteret stated that the pulp and paper industry employed at least thirteen branches of the engineering profession. Thus, the engineer occupies a very important place in the manufacture of pulp and paper. His widest field of usefulness, however, is probably in improving methods of converting and transporting raw material from the forest to the mills now in existence.

It was formerly considered good practice to tell the bush foreman to cut so many logs in a certain region, and if he got them at a reasonable price, the logging was supposed to be a success in spite of the fact that only the best timber adjacent to the streams was being cut and that the forest was being wasted. To-day, the engineer is employed to survey and map the timberlands in advance of the logging operations; topographical plans show definitely how best to log and bring out the timber.

Engineers now locate and build storehouses or depot-camps where they will serve the greatest territory economically for the longest time. They also make careful reconnaissances and surveys for locating roads so that the best possible grades can be obtained and minimum maintenance result.

Until a few years ago dams for driving purposes were located and built in a haphazard manner and were often washed out or did not give the results which were expected on account of the lack of technical and meteorological knowledge displayed in the construction of the dam or the choice of the site. The use of engineering principles now does away with these troubles. Other river improvements such as side piers, holding booms, jam piers, etc., also claim the attention of the engineer.

Engineers, on many instances, were also called to supervise log drives and this important work was then found to have been accomplished with great dispatch and economy.

Probably the most useful servant of wood using industries is water, as it is the cheapest and most used means of transporting the raw material. However, the water courses designed by nature do not always suit our requirements. Hence, the use of flumes which often make it possible to obtain timber otherwise inaccessible. At times a flume may be used to deliver the wood output of several streams to one central point, thereby eliminating separate wood preparing plants. Again flumes may

be used to advantage in diverting wood from one watershed to another. Water sluices are also used to load wood into boats or cars.

All those works and many others, said Mr. deCarteret, are of interest to the engineer and call for his resourcefulness and ingenuity.

It will be the engineers' task to bring vast areas of forest lands, at present inaccessible into close communication with business centres; railways will have to be built; towns laid out; harbour works constructed; channels dredged and vessels more suitable for carrying certain forest products designed and fabricated.

In places where, to-day, the forest stands untouched, to-morrow the engineer must exercise his skill in planning for the economic utilization of nature's wealth.

Concluding, the speaker asked: is this not scope enough for the engineer? Does it not give him ample opportunity to make a permanent record of his labours and should he not derive great satisfaction in so doing?

Paul Joncas, A.M.E.I.C., professor at the Laval Forestry School, then said a few words expressing the feelings of all the members present, and moved a vote of thanks to Mr. deCarteret which was heartily carried.

Arthur Fournier, A.M.E.I.C., also moved a vote of thanks to the Chairman for the able manner in which he had presided at the meeting. Carried.

St. John Branch

Harry F. Bennett, A.M.E.I.C., Secretary-Treasurer.

Hydro-Electric Situation

The regular monthly meeting of the Branch was held on Thursday, Jan. 19th, with F. P. Vaughan, M.E.I.C., in the chair. The discussion on the Hydro Electric situation and its relation to the City of St. John was continued by Herbert Phillips, M.E.I.C., who has taken an active part in the public discussions, as an advocate of Municipal Distribution.

The available water in the Musquash River, the question of a steam standby, the demand for power, and the relative costs in the several provinces were discussed by Mr. Phillips and Messrs C. C. Kirby, M.E.I.C., C. O. Foss, M.E.I.C., S. R. Weston, A.M.E.I.C., and several others.

This question is receiving extensive publicity in St. John and the Branch has devoted two meetings to the discussion of the various sides of the question.

Annual Meeting of the Association of Professional Engineers of the Province of New Brunswick.

The second annual meeting of the Professional Engineers of New Brunswick was held in St. John on Jan. 27th. with a large attendance of members from all parts of the province. The Annual report of the Council showed a total registration of 179, and the financial statement, a surplus of $2,889,67.

The election of officers for 1922 resulted as follows:

President...S. B. Wass, A.M.E.I.C., Moncton, N.B.
Vice-Pres...C. C. Kirby, M.E.I.C., St. John, N.B.
Councillors, St. John District, F. P. Vaughan, M.E.I.C.
H. F. Bennett, A.M.E.I.C.
" Moncton District J. D. McBeath, M.E.I.C.
K. S. Pickard, A.M.E.I.C.
" Fredericton " B. M. Hill, M.E.I.C.
" Chatham District R. J. Sandover Sly, A.M.E.I.C.

C. C. Kirby, M.E.I.C., the retiring President addressed the meeting on the necessity of high standards and greater service to the public. The benefits of organization and the spirit of Brotherhood were emphasized and the members were given a very vivid picture of the ideal to which they should strive to attain.

At the conclusion of the business meeting the members adjourned to the LaTour Hotel where a special dinner was served under the auspices of the St. John Branch of *The Engineering Institute of Canada.* Among the guests were the Hon. W. E. Foster, Premier of New Brunswick, and Commissioners J. B. Jones, T. H. Bullock, and J. H. Frink of the City of St. John.

After a very fine dinner, S. R. Weston, A.M.E.I.C., asst. chief engineer of the N.B. Power Commission addressed the gathering on the development of Hydro Electric Power in this province. He pointed out that we have not a Niagara available in this province, but we have a large number of small powers which are capable of economic development. The question of the advantage of such power is not an issue, but it is necessary for the province to have a cheaper and more abundant supply to adequately develop our industries. He hoped that the province would benefit by the developments carried out by the Power Commission.

C. C. Kirby, M.E.I.C., said that every organization should thoroughly discuss this Hydro question. It was a duty that the engineers owed to the public, to throw additional light on this matter by discussion.

Hon. W. E. Foster, in proposing the toast to the engineering profession, said that he felt honoured to speak before a profession that had done so much in building up Canada. The engineering profession was an honoured one, and he did not wonder that youths were attracted to it. The great Quebec, and other bridges, the railways and water power developments, were monuments to the engineers. After touching on the finances of the province and the need for economies in all branches, Mr. Foster concluded by stating that public works of a national character were required in St. John. The people demanded that Canadian traffic should pass through Canadian ports. They were not sufficient facilities here for that traffic and works undertaken should be completed without delay.

S. B. Wass, A.M.E.I.C., the newly elected President of the Association, expressed the gratitude of the visiting members for the able manner in which they had been entertained by the St. John Branch.

Retiring President's Address.

C.C. Kirby, M.E.I.C.

In retiring from the Presidency of this Association I feel it incumbent upon me to make a few remarks, other than those in the way of the pleasant duty of thanking you for your suffrages and support in

the past and assurance of my continuing assistance in the future to our new president and the Association as a whole, as far as I am able to do so.

The present moment appears to me to be a fitting one in which to review with you what has already been accomplished and what, as I conceive it, we are endeavouring to achieve in the future. Our Association will in a short while enter upon the third year of its corporate existence. In looking back we find that we have attained the goal, in form at any rate, the engineers have been seeking for the past twenty years and more. The engineering profession in this Province is a closed corporation sanctioned by legal enactment. Is this in itself a desirable and profitable achievement looked at from the point of view of individual members and the community in general? I frankly and freely state that I believe it is not, but what that it is only a necessary and proper means to an end. What then is this end which we are seeking. That is a very difficult thing to express in a few words but perhaps the terms character and service will give us some light upon a somewhat misty objective.

As was most eloquently brought out in a recent address to the E.I.C. by a prominent member, there is a need today for the development of the tribal spirit or soul of the engineering profession. It is no uncommon thing among engineers to experience a feeling of reluctance or almost of being ashamed to have to reply to a query as to the nature of one's occupation, "I am an engineer" for fear that one's hearers might think to themselves "Oh, only an engineer" with a feeling of disdain or pity, whereas there should be as much right to be proud of being able to say "I am an engineer" as of being able to say "I am a Canadian" or "I am a British Citizen" in any part of the world. That is one of the basic principles that we want to have underlying the character of all the members of our profession, pride and occupationr and with it will go pride of work accomplished, however simple or unromantic it may happen to be, even if it be only the making of a tracing or a blue print.

Then again there is service. Service to our employee. Yes that is of course the bounden duty of all true men. To do what is expected of us; but there is for engineers a further opportunity than that. Not only should the very name engineer imply duty always well and truly done but more than that, it should mean willingness to do more than duty. Willingness to be of service to others in the community, to the state, to our neighbors, to our brother engineers, and without expectation of additional reward. Not for notoriety or for influence or power but for love of the profession and the work itself and the exercise of knowledge and experience for the good of others and the feeling that we have done the best we could and made the most of our opportunities of service.

Our opportunities of service are different from those of all other occupations and professions. Our point of contact with the public is very different from that of other professions. We don't as a rule, come into direct contact with the public as do for instance the doctor and the dentist their contact is personal contact of a very pronounced type with individuals chiefly. The lawyer comes in contact with individuals also but from a psychological rather than a physical aspect and in his public appearances in his profession he is protected and glorified by his robes of office and his privileged position in the public courts. However, these men have to reply upon their hold upon the public for their means of livelihood and their rewards are very largely in proportion to their individual merit.

With us the case is different, the majority of us receive stated salaries and our contact with the public is not personal. Our opportunities for creating public opinion favourable to us lie, therefore in organization work rather than personal work of this character. We must organize ourselves for service to the public. This brings us to the question of what is the value to the individual member in joining an organization in which he may not be able to take an active part. When we consider the matter we find that engineers may be grouped in three broad classes. Those who work in large centres of population, those in medium sized centres and those in very small centres or among no population at all. With the engineering profession there is no general proportion between the number of engineers present and the size of the community. It cannot be figured that it takes so many persons to support an engineer as can roughly be done with lawyers, doctors and dentists. The number of engineers in a community depends more upon the types of industry in a community or the location of Government or Corporation Headquarters than anything else, although there is a rough general proportion that a large town will have more engineers in it than a small town. Though some small towns may have two or three times the number of engineers of some larger town.

In the cases of large towns with large numbers of engineers the situation as it exists today is not as good as in the smaller centres. The reason is that of greater difficulty of organization and the less opportunity there is for the general average of members to take prominent parts, with the result that large numbers have no part at all and are indifferent to the calls of organization. In the smaller towns organization is easier and personal intercourse between all of the members is possible, and it is here that community service finds its best expression at present.

In the third case where only a very few engineers can be found in any one locality the case is again different. The feeling that it is not worth while to belong to any organization has in the past been very prevalent. The successful organization of this Association is evidence that this feeling is passing away or has at least been suppressed for a while, with a view to giving organization a chance to show what it can do. Well what can it do to brighten the lives, build the character, improve the prospects of isolated members and those of the lower ranks. These are the questions which are of importance to the large majority of the membership. The public also has a right to know what will be the result of giving special privileges to any group of citizens by passing legislation for their use.

Let us take these questions separately and see how they can be answered.

Moncton Branch

M. J. Murphy, A.M.E.I.C., Secretary-Treasurer.

The regular monthly meeting of the Moncton Branch of *The Engineering Institute of Canada* was held Thursday evening, January 5th, in the Happen Inn tea rooms, where a chicken dinner was served at 6.30 P.M. A large number of members and several guests were present. J. D. McBeath, M.E.I.C. asst. city engineer, presided, and after dinner announced that Vincent Doucett would render a violin solo, accompanied by Major W. A. McKee. Mr. Doucett delighted the audience and was heartily encored.

The Chairman spoke briefly, wishing each member and guest a happy and prosperous New Year. He stated that the *E.I.C.* had done such gratifying work in the last year, and he expressed his belief that it is only through an organization such as *The Engineering Institute* that the engineering profession will attain the status it deserves.

Mr. McBeath then introduced City Engineer John Edington, M.E.I.C., declaring that as a hydraulic engineer he had no peers in Eastern Canada. Mr. Edington then read a very interesting paper on the history of the Moncton City Water Supply.

The water supply of any community is one of the most important factors in connection with its existence; therefore great care must be observed in selecting the best available source, whether it be a lake, river, impounding reservoir or artesian wells. Cities and towns that are situated in proximity to lakes or large rivers can get their supply direct, while others have to construct impounding reservoirs to store sufficient water during the rainy seasons to tide them over the dry, such as is the case in Moncton. We are fortunate here, however, in having brooks within reasonable distance of the city.

Where storage reservoirs are to be constructed some of the essential features to be first determined are the dry season flow of brooks, annual precipitation and the area of watershed. It then becomes necessary to look for the best natural site for the dam, which, for a gravity supply, should be at a point where sufficient head can be obtained to deliver the water with ample pressure throughout the area of consumption. The size of the dam is determined by the amount of water that is required to be

impounded in order to guarantee the supply during dry seasons and the reservoir should at least contain enough for 120 days.

The leading main from the reservoir should be of ample size, laid in as direct a line as possible, the grade of which to be such that at no point should the pipes be above the hydraulic grade line. Air valves are placed at all summits and flush valves at each depression throughout the line, as well as sufficient gate valves to facilitate repairs.

The distribution system should be laid in gridiron fashion, and no pipe should be less than 6 inches in diameter where fire hydrants are located. Gate valves should be placed on branches at street intersections.

Such are a few of the principle features of a simple gravity supply.

A brief history and description of the Moncton water supply may doubtless be of some interest. This water supply was first introduced by a private concern, the Moncton Gas, Light and Water Co. This company was incorporated by Provincial Act in 1877, and the following year an act was passed enabling the town to contract with the company for water and gas, and an agreement was entered into between the town and the company in November 1887, for a term of ten years.

The original works were designed by Gilbert Murdock, of St. John, and E. H. Keating, of Halifax, both now deceased. The former acted as consulting engineer until 1883, when the writer was appointed engineer of the company.

It might be in order to deviate a little from the subject and refer briefly to the other utilities controlled by this company.

In 1885 an electric lighting system was installed and the machinery placed in the Sugar Refinery which was run there for about a year until a suitable building was erected at the present site. The initial plant consisted of a 50 H.P. side crank engine and a 40 light direct current, Thompson Houston dynamo, supplying 35 arc lamps of 2,000 candle power for street lighting. The gas works were completed shortly after the water works and had a capacity of 5,000,000 cubic feet per annum. The principal consumers were the Intercolonial Railway, Sugar Refinery, Cotton Factory, Record Foundry, stores on Main Street, and also the street lighting.

About the year 1893 citizens' meetings were held with a view of acquiring the company's plants, and in 1894 an act was passed enabling the city to expropriate the entire works of the company. Arbitration proceedings opened on August 28th, and were concluded on September 15th, the arbitrators being as follows: Walter Shanley, C.E., of Montreal, for the city, chairman; Robert Surtees, C.E., of Ottawa, for the city, and F. W. Holt, C.E., of St. Stephen, N.B., appointed by the Government of New Brunswick. The award of the arbitrators was as follows:

Water works system	$265,050.00
Electric lighting and gas works	78,658.00
Total	$343,708.00

The city also assumed $60,000 water works 6% bonds that had been issued by the Company. In January, 1895, the city disposed of debentures to the amount of $350,000, in order to pay the award. The city took possession of the works in 1895.

The Irishtown reservoir was constructed on Black Mill Brook, from which duplicate mains convey the water to the city, a distance of about 3¼ miles. One of these mains, the original, was laid in 1878, and the other in 1904. The area within the water shed is 5 square miles. When first constructed the wasteway was at an elevation of 136 feet above city datum, and the reservoir had a capacity of 35,000,000 gallons. The height of the dam has been increased twice since then, first to 144 feet, giving a capacity of 138,000,000 gallons, and later to 147 feet at wasteway, its present level, giving a storage capacity of 250,000,000 gallons. The difference in elevation between Main street at city building and wasteway at dam is 119 feet, and at highest point of city, 40 feet. The topography of the surrounding country is such that this reservoir cannot be raised much above its present level.

About two miles above this reservoir another dam, 14 feet in height, was constructed, 1889-90, giving a storage capacity of 10,000,000 gallons.

As the consumption increased, a pumping station was constructed, in 1889, and a 10 by 16 by 12 in. duplex steam pump installed. In 1909, an addition was made to the station, and two 1-stage turbo electric pumps, having a nominal capacity each of 2,000 gallons per minute, were installed. Both pumps were adjusted so that they could be operated in series, in multiple, or singly. The steam pump was then abandoned.

As the city increased in population it soon became evident that an additional supply would be required; therefore surveys were commenced with that end in view, and the McNutt Brook was finally decided upon as the source of new supply. Contracts were entered into in August 1911, and the entire system was completed in the fall of 1914, the water being turned on in the city on December 17th, 1914. The reservoir is located about 3½ miles from the city on the McNutt Brook, and has a capacity of 300,000,000. The dam is so constructed with berms on both slopes that it can be raised at any time. The mains through dam are in duplicate 20 in. in diameter, and the gatehouse has double screen chamber. Water can be drawn off at intakes located at three different levels.

The leading main from reservoir to pumping station is 20 inches in diameter.

The pumping station is equipped with the following: one centrifugal pump, capable of delivering 3470 Imperial gallons per minute when operating at 750 R.P.M. The pump is driven by a rope drive, which consists of 26 one inch cotton ropes. The motive power is a Premier gas engine, having four cylinders side by side, and capable of delivering 460 B.H.P. when running at 200 R.P.M. A special speed indicator is provided in the engine, so that the speed may be changed instantly from 160 to 200 R.P.M. The water pressure at the pump delivery may therefore be changed instantly from domestic to fire pressure as required, these pressure being 45 lbs. to 75 lbs.

respectively. The fuel is natural gas. An emergency source of power is provided in the shape of a suction gas producer for operating on pea anthracite coal, also auxiliary apparatus for blowing in the producer and for supplying compressed air for starting the gas engine. There are also the two turbo electric pumps which were transferred from the old pumping station, thus giving two separate and distinct units of supply. The mains from Irishtown reservoir are now connected to suction pipes in new pumping station and are common to both pumps. This arrangement give a very elastic system of supply, for if one pump gives out, the other can be started up and should both give out, there would still be the gravity supply which would give from 25 to 30 lbs. on Main street. The discharge mains from pumping station are two in number, 18 inches and 16 inches in diameter, laid to centre of distribution on St. George street and both along separate routes.

The population of Moncton, when the water works were first constructed was about 5,000. Since then the system has increased from a storage reservoir of 35,000,000 gallons, with about 7 miles of leading and distribution mains, to a system of 550,000,000 gallons, with 38¼ miles of leading and distribution mains, the population now being over 20,000. The daily consumptions averages 3,000,000 gallons, the largest consumer being the C. N. Railway.

On the completion of Mr. Edington's paper, the Chairman introduced Edward Holgate, chief engineer of the MacKinnon Bridge Co., of Sherbrooke, P.Q. Mr. Holgate, who is in charge of the designing and erection of the new skating rink at Sunny Brae, spoke briefly on the unique features in connection with this structure.

The ground plan is a circle 200 ft. in diameter; the roof is a truncated cone of 45% pitch, composed of 16 rafters resting on 16 columns.

The tension at the line of the eaves, he explained, is taken up by a heavy steel plate corresponding to the rim of a wheel, and an equal and opposite compression force is resisted by seven circular lines of purlins designed to take compression.

The rafters themselves are compression members only. Mr. Holgate gave other interesting details, introduced to provide for concentrated uneven loading. He also outlined his very interesting method of erection.

After considerable discussion by the members, the Chairman in tendering a vote of thanks and appreciation to Mr. Holgate, for his very interesting address, given on such short notice, expressed the wish that we could have the pleasure of listening to another address from Mr. Holgate in the very near future, when he would have a longer period to prepare it.

Cape Breton Branch

[illegible], A.M.E.I.C., Secretary-Treasurer.

A regular monthly meeting of the Branch was held at the Bank of Commerce rooms, on Thursday, February 9th.

In the absence of the Chairman of the Branch, the meeting was presided over by Horace Longley, M.E.I.C., who called upon Geo. D. Macdougall, M.E.I.C., chief engineer of the British Empire Steel Corporation, to read his paper on "Shipbuilding".

Mr. Macdougall, who had made a special trip from New Glasgow, said that, owing to short notice and hasty preparation, his paper was in a somewhat incomplete condition. He gave a brief historical sketch of the development of shipbuilding from the earliest recorded vessel, — the Ark, whose dimensions, he stated, were quite in accordance with present day practice, to the modern ocean going cargo boat. His paper dealt more particularly with the latter type of vessel, which represented by far the most important and most numerous class afloat.

Recalling the prominent part which Nova Scotia, as a Maritime Province, had always taken in Canadian shipbuilding, Mr. Macdougall told of the origin of the New Glasgow and Halifax Yards, and the difficulties which had to be overcome, difficulties which had taxed the ingenuity of those responsible, and demonstrated the capabilities of the ordinary machinist and mechanic, to whom great credit was due for their share in the development of a new industry. Most of the vessels built at the New Glasgow yard during the war had been framed, engined, and, with a few small exceptions, such as wireless, fitted completely with local labour, with local material.

Enlarging on this side of the question, Mr. Macdougall, without going into the strictly technical side, described in more detail how these two yards had overcome the problems with which they had been confronted, those in charge drawing on the resources of the allied companies. In concluding he expressed the opinion that the people of Nova Scotia would do well to devote more thought to the matter of shipbuilding, and to sustaining the province in the premier position which it has always taken, it being the oldest and most essentially maritime province in the Dominion. He further undertook to deal with the more technical side of the question in an addition to his paper, to be presented at a later date.

Following the reading of the paper, numerous questions were asked. In reply to Mr. Longley, Mr. Macdougall said that there was one boat afloat which was electric welded throughout, but it had not been long enough in service to have been accepted by Lloyd's. Oxy-acetylene was permitted only for cutting, — all welding must be electric. In reply to K. H. Marsh, M.E.I.C., as to the percentage of plates requiring to be laid off in the mould loft, and as to the value of geared turbine drives, Mr. Macdougall said that only plates which had to be formed required to be laid off, most of the deck and seventy-five percent of the hull of the regular cargo boat was not formed. The only example of geared turbine propulsion turned out from their yards was the War Wasp, New Glasgow, 1917, which was still in service, although torpedoed twice, and she had given satisfaction.

On the motion of K. H. Marsh, M.E.I.C., seconded by D. F. MacIsaac, A.M.E.I.C., Mr. Macdougall was accorded a hearty vote of thanks for his paper.

The Chairman then called upon the Secretary to report on the Annual Meeting and the Branch Secretarial Conference. The Secretary outlined the origin of the

conference, and, reading in part from the minutes, gave a detailed account of the work dealt with and the conclusions arrived at. At the close of his report, the following motion by J. H. Fraser, A.M.E.I.C., seconded by I. W. Buckley, A.M.E.I.C., was carried unanimously:

"The Cape Breton Branch, situated in the most Easterly extremity of the Dominion, does endorse and appreciate the work of the Branch Secretarial Conference, and the opportunity afforded thereby for co-operation and advancement, and suggests and strongly recommends to Council that a similar conference of all Branch Secretaries throughout the Dominion, be held annually at the time of the annual general meeting of *The Institute*, and that Council should set aside a sufficient appropriation to cover the cost of such meeting."

Halifax Branch

O. S. Cox, A.M.E.I.C., Secretary-Treasurer.

The regular monthly meeting of the Branch was held in the Nova Scotia Technical College at 8 P.M., Jan. 17th. C. St. J. Wilson, A.M.E.I.C., read a paper on some construction problems encountered in local buildings taking for his subject three buildings recently reported on and strengthened under the supervision of the firm of Pickings and Roland of which firm Mr. Wilson is a member.

Building No. 1 is 45′ x 60′ in plan and four stories high, the two upper stories having been added at a later date. This building is at present used for warehouse purposes except the ground floor and part of the second floor which are used for show rooms and offices respectively. The live load would average from 75 lbs. per square foot to 100 lbs. per square foot. The third and fourth floor joists 3 x 12 spruce, 16″ cts. on spans of 16′-0″, 18′-0″, 19′-0″ and 25′-0″ are good for from 69 lbs. per square foot to 126 lbs. per square foot total safe load at 900 lbs. per square inch allowable bending stress. The original girders of the third floor consisted of four 2½ x 12 planks. When the additional stories were added the joists of the third floor were dapped down seven inches and an additional girder eight inches deep inserted above the old girders, these new girders being continuous over the centre support. By equating the deflections of the different girders, Mr. Wilson determined the proportion of the load carried by each beam and found that for an assumed live load of 40 lbs. per square foot (less than that called for in the design of an ordinary residence by the Halifax building code) the spruce timbers were stressed as high as 2950 lbs. per square inch in bending and to 311 lbs. per square inch in horizontal shear. For the same loading the main girder at the second floor carrying the second floor columns was stressed to 3440 lbs. per square inch in bending and 447 lbs. per square inch in horizontal shear. This girder was built up of four 3 x 12 spruce planks continuous over three spans of 20′-0″, 6′-9″ and 16′-0″.

Building No. 2 used entirely for warehouse purposes had reinforced concrete walls and is L shaped in plan. The second floor is carried by 20″ I beams at 80 lbs. about 14′-0″ centres and 33′-0″ span. The third and fourth floors and roof are carried by timber girders and columns resting about the third points of the 20 I beams. The loading in this building is extremely heavy and the building should be designed for from 250 lbs. to 300 lbs. per square foot. Assuming a roof load of 50 lbs. per square foot and a total floor load on each floor of 60 lbs. per square foot, these I beams would be stressed to 30,200 lbs. per square inch. One spruce beam in this building assuming the same loading is above and neglecting a portion of the elevator load which the beam carried, was stressed to 5830 lbs. per square inch in bending and 238 lbs. per square inch in horizontal shear. This beam had deflected over three inches.

Building No. 3 was also a warehouse building carrying the same loads as building No. 2. The joists in this building were limited by horizontal shear and were good for a safe load of 224 lbs. per square foot. The girders of 8 x 12 hard pine were also limited by horizontal shear and were safe for 78 lbs. per square foot or only about one third of the capacity of the joists. In one portion of this building, in order to provide a driveway on the ground floor, one column was removed and a trussed beam inserted to take its place. This beam consisted of an 8 x 12 spruce beam, and two-1¼ inch diameter rods with turn buckles. Assuming a 50 lbs. per square foot roof load and floor loads of 60 lbs. per square foot total load, these rods were stressed to 48,500 lbs. per square inch at the root of the threads.

Mr. Wilson pointed out several other very highly stressed members and condemned the present method of building construction, stringly advocating the insistance on technical supervision by the City authorities and the revision of the present Engineering Act in Nova Scotia which limits the cost of engineering work which must be designed by a registered engineer to work, costing over $25,000.00. He pointed out that a local contractor had prepared sketches for the strengthening of building number one, taking care of only a small portion of the defects and had offered to do the work for twice the amount expended under the final plans. The total cost of strengthening buildings numbers 2 and 3 was under four thousand dollars, and it was not necessary, under the Nova Scotia Act, to have the plans prepared by a registered engineer.

Considerable interesting discussion followed the reading of Mr. Wilson's paper, after which three moving picture films from the Exhibits and Publicity Bureau at Ottawa were shown, depicting various Canadian industries and natural resources.

Town Planning Notes and Comments

Horace L. Seymour, A.M.E.I.C.

NOTE: — *In order to make this column of wide interest to members of The Institute, personals and items of town planning interest will be appreciated. Address: Horace L. Seymour, A.M.E.I.C., 40 Jarvis Street, Toronto.*

Review of E.I.C. Branch Activities in Town Planning for 1921.

In the February issue, 1922 of *The Journal*, of the E.I.C., there will be found reports of the Branches. Interest in Town Planning is evidenced by a study of these reports.

Vancouver Branch

On February 9th., the Vancouver Branch held a luncheon; the subject of the address was "Town Panning" and was delivered by Thos. Adams, F.S.I. It might be mentioned that under recent Provincial legislation, Point Grey, adjoining the City of Vancouver, is it is understood, intending to prepare zoning maps and ordinances. Various use zones will be prescribed and building lines established.

Winnipeg Branch

On Nov. 16th., the Winnipeg Branch were addressed by Capt. W. E. Hobbs, A.M.E.I.C., on the subject of "Town Planning". The Branch report also states that Capt. Hobbs was appointed Commissioner of Town Planning for the Province. The administration of the 1916 Town Planning Act (Manitoba) is in good hands. It is understood that many applications have already been received from owners of land and municipalities, who have now under the provisions of the Act, to submit plans of subdivisions, to the town planning comptroller. Now that an official has been appointed to administer Town Planning legislation it is to be hoped that the advance in town planning in Manitoba will be as marked as in the Province of Saskatchewan, which has had a director of town planning for some time. The present director is W. A. Begg, A.M.E.I.C., Regina, Sask.

Sault St. Marie Branch

An extract from the report of the Sault Ste. Marie Branch, F. Theo. Gnaedinger, A.M.E.I.C., Secretary, reads as follows:

> "A Committee on Town Planning has been formed for the purpose of studying Town Planning principles and legislation particularly with reference to their application to the City of Sault Ste. Marie. It is our intention to stimulate public interest in the Sault in a City Planning movement. Already we have secured the promise of co-operation and support from an umber of local public bodies."

Border Cities Branch

On May 13th., J. Clark Keith, A.M.E.I.C., addressed the Border Cities Branch on "Park Scheme for the Border Cities". As engineer to the Essex Border Utilities Commission, Mr. Keith has taken great interest in Town Planning matters. Maps are being prepared of areas under his jurisdiction and these will form the basis for town planning development. Mr. Keith evidently recognizes the fact that a municipal engineer must keep in touch with Town Planning matters.

Hamilton Branch

A portion of the Hamilton Branch Report reads as follows:

> "March 23rd. "Town Planning" — J. W. Tyrrell, M.E.I.C., delegate to the Toronto Convention, gave his report, J. J. Mackay, O.L.S., M.E.I.C., a member of the Town Planning Commission and the Wentworth Road Commission, spoke on Road and Boulevards, and what they mean to Hamilton. This was published in *The Journal* for August, p-470."

The Toronto Convention referred to, was that of the Ontario Town Planning and Housing Conference. This Conference recently requested the Ontario Government to codify legislation in regard to Town Planning at present scattered through various Acts.

Interest in Town Planning in Hamilton has been furthered by the presence of such members of *The Institute* as J. W. Tyrrell and J. J. Mackay. Noulan Cauchon, A.M.E.I.C., consulting town planning engineer of Ottawa, has laid out for Hamilton a scheme of mountain roadways, part of which was already been constructed. The City of Hamilton is also interested in the railway situation and in harbour improvement, for both of which studies and reports have been made.

Halifax Branch

On December 9th., Mr. H. W. Johnson, assistant city engineer, presented a paper on Town Planning. Mr. Johnson was able to refer to the work of Town Planning in the City of Halifax, made necessary by the disastrous explosion in 1917. Mr. Johnson has always taken a keen interest in Town Planning matters.

The foregoing are some of the items gleaned from the Branch reports. Undoubtedly, some other Branches are also interested in Town Planning, although nothing appears in the Annual Report. For example the Toronto Branch which last year appointed a Committee on Zoning, this year appointed a representative to meet with a Committee from the Downtown Association of Toronto in furtherance of civic improvement.

High Buildings for London, England

Up to the present the Town Planner on this continent has been able to point to Europe for desirable examples in the control of the height of buildings. Sky scrapers have been shown to be economically unsound — that in cities where sky scrapers are built, the return on the investment may be lower than two percent; sky scrapers are unhealthy, cutting off light and air; sky scrapers cause undesirable congestion in street traffic. These arguments, the town planner urged, and pointed with considerable pleasure to, for example, the London Building Act, which limites the height of buildings to 80 feet above the street level. There is an agitation now that this limit should be changed to 120 feet and further, that where buildings face Parks or open spaces, buildings even to 150 feet high should be permitted.

The London County Council Committee has reported against the change but the agitation still continues. For ordinary conditions in our average Canadian cities, the writer believes that a safe rule to adopt is that which limits the height of the building to the width of the street.

French Course on City Planning.

Interest in Town Planning education is growing. Regular courses in certain phases of Town Planning are being given in some Universities in the United States and England. A two year course of study has been prepared for the School of Advanced Municipal Research, Paris, and was organized by *The Institute* of Urban History, Geography and Economics of the City of Paris. As stated, the course has to do with the planning, beautification, and extension of cities, and their administration economic, and social organization. The course is intended for students with a purely scientific interest; for architects and engineers offered a career by the provisions of the French Compulsory City Planning Law, and the public in General. The four principal courses are outlined in "Housing Betterment," for January, 1922:

1. Evolution of Cities — "The City considered as a living organism evolving in time and in space".
2. Social Organization of Cities — With Conferences on "Municipal Ownership in France and Abroad" and the "Hygiene of Housing".
3. Administrative Organization of Cities — With Conferences on "Urban Legislation of Tomorrow."
4. Urban Art. — With Conferences on the "Art of the Municipal Engineer."

Preliminary Notice

of Applications for Admission and for Transfer

18th February 1922

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate member a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in March, 1922.

FRASER S. KEITH, Secretary.

*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option, Railway, Municipal, Hydraulic, Mechanical, Mining or Electrical Engineering

This examination may be waived at the discretion of the Council if the candidat. has held a position of professional responsibility for five years or more years

Every candidate for election as JUNIOR shall be at least twenty-one years oe age, and must have been engaged in some branch of engineering for at least four yearsf This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects. Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations

Every candidate for election as ASSOCIATE shall be one who by his pursuits cientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

ALDER—WILLIAM ROBERT, of Cornwall, Ont. Born at Prescott, Ont., Aug 14th, 1886; Educ., B.Sc., Queen's Univ. 1907; 1907 (2 mos), dftsman., Delora Mining & Reduction Co., Deloro, Ont.; 1907-08, chemist in charge of ore analysis, Bessemer Iron Mine for Munecal Range Iron Mining Co.; 1908 (3 mos), on magnetometric surveys of iron properties, Hastings Co., for Canada Iron Corpn.; 1908-09, chief chemist, Manufacturer's Corundum Co. at Craigmont mill; 1911-13, asst. engr. during reconstrn. of Kingston & Pembroke Rly; 1913-14, mtce., of way engr'g. staff, dist. No. 1, Ont. Divn., C.P.R.; Aug. 1919 to date, on eng'g., staff, Dept. Public Highways of Ontario, as asst. res. engr., at Cornwall, in charge of survey parties and directing road and culvert constrn.

References: F. Stidwell, J. G. Cameron, G. Hogarth, H. T. Routly, J. B. Wilkinson.

ALDOUS—HERBERT, of 606 Manning Avenue, Toronto, Ont. Born at Watford, Herts., England, Sept. 15th, 1893; Educ., London College of Munic. and Sanitary Engr'g., 1915; 1919-21, large public works contract, Norwich, England, including brick and reinforced concrete bldgs., sewers, drains, water mains, new road, water softenin;g 1921, inspr., Ont. Dept. Public Highways. Not employed at present.

References: W. A. McLean, R. O. Wynne-Roberts, W. Storrie, G. T. Clark, F. B. Goedike, W. R. Worthington.

AMES—ARTHUR JOHN, of 184 Centre Street, Ottawa, Ont. Born at London, England, Sept. 25th, 1880; Educ., City of London College, London ,England. 4 years special training under Frank C. Watts, senior partner, E. R. Watts & Son, Surveying and Scientific Instrument Mfrs., London, England; 7 yeras, sales engr., E. R. Watts & Sons, London, and 9 years, managing director, E. R. Watts & Son, Canada, Ltd., in full charge of the Canadian Business now known as "Instruments Limited.

References: G. B. Dodge, N. J. Ogilvie, J. L. Rannie, O. S. Finnie, F. G. Smith, F. S. Keith.

ARNOLD—NORMAN JOHN, of 722-6th Avenue West, Calgary, Alta. Born at London, England, Jan. 1st, 1891; 1908, rodman and leveller, C.P.R location; 1910, instr'man., mtce. of way, G.T.P. ; 1911, constrn., C.P.R. Transcona; 1912, instr'man. in charge of track laying, G.T.P.; 1912, rodman, C.P.R., D.N.R.; 1913-14, instr'man and dftsman., irrigation branch, Dept. of the Interior; instr'man. Can. Land and Irrigation Co., Medicine Hat, Alta.; At present, Instr'man., Lethbridge Northen Irrigation District, Lethbridge.

References: C. M. Arnold, P. M. Sauder, F. M. Wood, G. N. Houston, F. K. Beach.

BAIRD—ALBERT FOSTER, of Fredericton, N.B. Born at Salmon Creek, N.B., Dec. 6th, 1891; Educ., B.Sc. 1914, M.Sc. 1917, Univ of N.B.; Student ap'ticeship course, Ca.n Westinghouse Con., Hamilton, during vacations; 1915-16, instructor in physics, Kansas State College; instructor in physics, Macdonald College, Ste. Anne de Bellevue; 1916-19, acting professor of mech. engr'g., Univ. of N.B. 3 years and 2 mos. in charge of this dept.; Summer 1920, engr'g. office, Northern Electric Co., Montreal; 1920 to date, professor of physics and electrical engr'g., Univ. of New Brunswick, Fredericton, N.B.

References: E. O. Turner, J. A. Stiles, F. P. Vaughan, C. O. Foss, B. M. Hill, T. W. Lesage.

BOCKUS—GERALD LETHWYN, of 26-A Wolfe Street, Sherbrooke, Que. Born at Mystic, Que., Sept. 21st, 1885; Educ., I.C.S. elec engr'g., 1907; Served ap'ticeship and later in elect'l dept. (power plant division), Hartford Street Rly. Co.; 1906, inspr. of plant equipment, elec.dept., Montreal Locomotive Works: 1907-09 foreman, Shawinigan Water & Power; 1909-11, travelling salesman; 1911-12, supt., elec. dept., Canada Paper Co.; 1912-14, erecting engr., Canadian Westinghouse Co.; 1914-15, plant engr., McCormick Mfg. Co., London, Ont.; 1915-16, erecting engr., Canadian Westinghouse Co.; 1916-17, in charge of power house and elect'l. equipment, McGill University; 1918 to date, supt. of power, City of Sherbrooke, Que.

References: C. J. Desbaillets, H. Holgate, L. A. Herdt, R. S. Kelsch, J. M. Robertson, J. C. Smith, M. A. Sammett, F. Thomson, T. Tremblay.

BOYD—JOHN WILLIAM GAMBLE, of 35 Elgin Avenue, Toronto, Ont. Born at Teddington, England, Feb. 10th, 1897; Educ., Toronto Technical School (elec. engr'g.); 1916-18, overseas, Flight Lieut., R.F.C.; 1918 (Aug. Nov.), 1st. asst., tech. dept., Canadian Aeroplanes; 1919-1920, organized and in charge of repair dept., Can. Gen. Elec. Co., Toronto. Asst. to supply dept. engr., Lamp Base Works (C.G.E. Factory); Completed survey with Northern Development Branch in October 1921.

References: C. H. Fullerton, M. B. Watson, R. O. Wynne-Roberts, J. C. Meader, W. Storrie.

BRABAZON—CLAUDE HUGH, of Ottawa, Ont. Born at Portage du Fort, Que., Oct. 18th, 1886; 1905-06, asst. in charge of sub party on Alaska Boundary Survey; 1907-08, in charge of sub party on Yukon Boundary; 1909-13, Maine and N.B. Boundary; 1914 to date, engr., in charge of primary triangulation party, Maritine Provinces, for Geodetic Survey of Canada, Dept. of the Interior, Ottawa.

References: J. J. McArthur, N. J. Ogilvie, J. D. Craig, W. M. Tobey, F. B. Reid, D. H. Nelles, C. R. Coutlee, A. M. Grant.

CANNIFF—STANLEY W., of 6 Second Avenue, Ottawa, Ont. Born at Napanee, Ont., Aug. 27th, 1885; Educ., Senior Matric., Napanee Collegiate Institute. I.C.S.; 14 years with the Can. Gen. Elec. Co. as follows — 4 years course in elec. engr's. Peterboro, 2 years supt. of transformer testing dept., Peterboro, 4 years in engineering dept., designing direct current machines, transformers and station layouts, 2 years asst. supply dept. engr., Toronto, and 2 years in the sales dept., Toronto; 7 years to date, test engr., Ottawa Hydro-Electric Commission, Ottawa.

References: J. E. Brown, P. L. Allison, C. E. Sisson, L. De W. Magie, J. H. Thompson, A. B. Lambe.

CLARK—FRANK JAMES, of 212-11th Street South, Lethbridge, Alta. Born at Amherst, N.S., March 31st, 1889; Educ., 2 years McGill Univ.; 1906, with Mountain & Milling Co., Isaac's Harbour, N.S., 1906-12, with G.T.P. Rly., 1910-12 in charge of concrete and timber bridges on mountain divn. west of Edmonton, Alta.; 1912-14, in charge of work on E.D. & B.C. Rly. at Mirror Landing and High Prairie, Alta.; 1914-19, overseas; 1920 to date, res. engr., Lethbridge Northern Irrigation District, Lethbridge.

References: H. B. Muckleston, C. M. Arnold, R. J. Gibb, F. S. Dyke, P. M. Sauder.

CUNHA—STANLEY HERBERT, of Montreal, Que. Born at Kingston, Jamaica, B.W.I., Feb. 15th, 1882; Educ., B.Sc., McGill Univ. 1905; 1899-1901, ap'tice, Royal Naval Dockyards, Port Royal, Jamaica; 1906-07, test dept., General Electric Co., Schenectady; 1907-09, Jamaica Co., central factory work; 1909-12, test dept., and from 1912 to date, engineering dept., Montreal Light Heat & Power Co., Montreal. At present, elect'l. engr.

References: R. M. Wilson, E. J. Turley, L. A. Kenyon, A. Wilson, W. D. Walcott.

DOGHERTY—ALEX. CHARLES, of Montreal, Que. Born at Montreal, Sept. 6th, 1891; Educ., I.C.S. elec. engr'g.; 1908-10, shops, offices and dfting room, Northern Electric and Mfg. Co.; 1910-11, dftsman and switchboard erection, Allis-Chalmers Bullock, Rockfield, Que.; 1911-13, dftsman. and asst. engr. and 1913-14, elec. engr., T. Pringle & Son Ltd., Montreal; 1914-15, designed and supervised constrn. pumping and elect'l. equipment for the Corby Distillery Co. Ltd., Corbyville, Ont.; 1915-17, overseas; 1917 (May-Dec.), res. engr. on hydro-elec. development for Penman's Ltd., Coaticook, Que. under T. Pringle & Son; 1918, elec. engr., with Wayagamack Pulp & Paper Co., Three Rivers, Que.; Jan. 1919 to date, elect'l. and mechanical engr., T. Pringle & Son Ltd., Montreal.

References: J. S. Costigan, G. M. Wynn, A. H. Milne, P. O. G. Janes, A. Pringle.

DOW—JOHN, of Lethbridge, Alta. Born at Whitehouse, Aberdeenshire, Scotland, May 6th, 1879; Educ. elec. engr's. course, Robert Gordon's College, 1903-04. Special engr'g. course (9 mos.), Automatic Electric Co., Chicago, Ill.; 1904-09. served ap'ticeship. in all branches of telephone engr'g., National Telephone Co.; 1909-12, install'n. of automatic telephone switchboards etc., Automatic Electric Coy., Chicago, Ill.; 1912 to date with Alberta Govt. Telephones, at present plant chief.

References: S. G. Porter, C. M. Arnold, C. D. MacKintosh, G. N. Houston, H. W. Meech.

DRYBROUGH—JOHN, of 14 Charles Street East, Toronto, Ont. Born at Leith, Scotland, Aug. 5th, 1896; Educ: At present in 4th, year, Faculty Applied Science, Univ. of Toronto; 1913-15, asst. chemist, Mond Nickel Co. Ltd., Coniston, Ont.; 1916-19, overseas; 1920 (May-Aug.), British American Nickel Corpn., Nickelton, Ont.; 1921 (May-Sept.), asst, Can. Geol. survey party.

References: C. H. Mitchell, C. R. Young, H. E. T. Haultain, P. Gillespie, J. R. Cockburn.

ELLIS—OWEN WILLIAM, of 539 Church Street, Toronto, Ont. Born at Swindon, England, Sept. 22nd, 1888; Educ:, B.Sc. 1914, M.Sc. 1917, Birmingham Univ.; Assoc. M. Inst. C.E. 1915; 1905-10, ap'tice, Gt. Western Rly. Locomotive Works, Swindon, England; 1910, machinist, and 1910-11, educational instructor (under supervisor of apprentices), C.P.R. Angus shops, Montreal; 1914-15, supervisor (asst. to mgr.), 1915-16, prin. asst. metallurgist, and 1916-21, metallurgist, Royal Laboratory Dept., Royal Arsenal, Woolwich, England; At present, lecturer on metallography and on iron and steel, Univ. of Toronto, Toronto. Also consltg. metalluragical engineer.

References: C. H. Mitchell, H. E. T. Haultain, A. Stansfield, P. B. Roberts, J. Griffith, W. J. Smither, C. R. Young, P. Gillespie.

FIELD—REGINALD HUGH, of 12 Rockcliffe Way, Ottawa, Ont. Born at Rotherfield, Sussex, England, Jan 11th, 1890; Educ. 1st class cert., Univ. of Liverpool, 1913; 1906-10 and during vacations premium ap'tice, London & North Western Rly., England; 1913 (2 mos.), dftsman., Dom. Bridge Co., Lachine; 1913-14, inspr. for the Can. Inspecting and Testing Laboratories; 1914 to date, at the Surveys Laboratory, Dept. Interior, Ottawa, examining, testing, adjusting and reporting on various engineering instruments etc., under direction of W.C. Way.

References: W. C. Way, J. J. Rannie, S. W. Perrott, E. M. Dennis, G. B. Dodge, H. A. Dupre.

HENDERSON—MELVILLE GRANT, 533-7th Street South, Lethbridge, Alta Born at Tara, Ont., Sept. 27th, 1895; Educ., B.A.Sc. Univ. of Toronto, 1920; 1916-19, [illegible], 4 mos., constrn. of hydro-elec. [illegible], Ont.; 4 mos., shell manufacture, 1915; 1921 (5 mos), field office work and instrument work, Lethbridge Northern Irrigation District, Lethbridge, Alta.

References: L. M. Arkley, P. Gillespie, P. M. Sauder, F. S. Dyke, H. B. Muckleston.

HILLIARD—GEORGE FREDERICK HERBERT, of Lethbridge, Alta. Born at Minnedosa, Man., March 13th, 1888; Educ., Grad. R. M. C. Kingston, 1908; 1908, topog'r., Militia Dept.; 1909, prospecting, Gowganda and Northern Ontario; 1910, topog'r., Militia Dept.; 1910-11, leveller, prelim. and location survey, 1911-12, instr'man. on constr'n., Algoma Central & Hudson Bay Rly.; 1913-15, asst. engr. to city engr., Peterborough, Ont.; 1915-19, overseas, C.F.A.; April 1920 to date, res. engr., Lethbridge Northern Irrigation District.

References: P. H. [illegible], H. B. Muckleston, C. M. Arnold, P. M. Sauder, F. S. Dyke.

LACKYER—RICHARD HENRY NORMAN, of Bonnington Falls, B.C. Born at Vancouver, B.C., Nov. 5th, 1893; Educ., 3 years science, McGill Univ. Master of Electricity, State of West Va. Univ., 1914; 5 years, in charge of elec. install'n. in connection with the Hudson's Bay new store, Vancouver; 1915-18, in charge of the install'n. and operation of 20,000 horse power plant for the Consolidated Mining & Smelting Co., Trail, B.C.; 1918-21, in charge of the West Kootenay Power & Light Co's. interests at Trail, B.C.; May 1921 to date, asst. supt. of the West Kootenay Power & Light Co's. generating actions, Trail, B.C.

References: B. R. Warden, A. E. Wright, T. H. Tracy, A. Walkem, T. W. Fairhurst.

LESSARD—C. CAMILLE, of 1 Avenue Jacques Cartier, Quebec, Que. Born at Quebec, Que., Sept. 26th, 1889; Educ., B.S.A. and C.E., Laval Univ. 1911; During College vacations, rodman etc., on location and constrn., T.C.Rly., and junior asst. on staff of A. R. Deary, Dept. P.W. Canada, Quebec,; 1911-15, asst. to the district engrs., Dept. P.W. Canada, Quebec; 1915-17, city engr., Levis, Que.; 1917-19, engr. for the town of Bienville, Que.; 1919 to date, in private practice with C. E. Gauvin, C.E., Quebec, Que. (During winter 1922, asst. to chief engr., I. E. Vallée, Public Works and Labour, Quebec.

References: A. R. Decary, C. E. Gauvin, I. E. Vallée, A. B. Normandin, J. A. Buteau, E. S. T. Lavigne, J. N. H. Cimon, F. B. Painchaud.

MACFARLANE—ATHOL HERRIDGE, of Baghdad, Mesopotamia. Born at Ottawa, Ont., 1891; Educ., 3 years S.P.S. Univ. of Toronto; 1906, Yukon Govt. Survey; 1907, road constrn., Y.T.; 1908, firing, operating and constrn. foreman, Joe Burke Mining Co., Y.T.; 1909, electrician, Guggenheims, Y.T.; 1910, electrician,constructional foreman, Northern Light Power Co. — Bonanza Basin Gold Dredging Co. — North Fork Power Co., Y.T.; 1911-12, constructional engr. (elec.) Bonanza Basin Gold Dredging Co.; 1913, B.C. Electric Co., Victoria, B.C.; 1913, Canadian Collienie (D) Ltd., in charge elect'l install'ns. No. 4, Vancouver Island; 1914, bridge inspr., Sask. Govt.; 1915-19, overseas. Awarded M.C.; 1919-20, elec. and mech. surveyor for D.S.C.R., Vancouver; 1920 to date, asst. director of irrigation, Baghdad, Mesopotamia.

References: G. B. Hull, H. D. St.A. Smith, L. W. Klingner, H. C. Lott, H. S. Carpenter.

MARSHALL—NATHANIEL, P. O. Box 307, Lethbridge, Alta. Born at Belfast, Ireland, Oct. 25th, 1862; Educ., 6 years ap'ticeship to engr'g., at same time attending night classes at Technical School. 1st class cert. British Board of Trade, 1888; sailed as 3rd, 2nd, and 1st engr., in various ships; 10 years and 3 mos., engr. surveyor, under Lloyds Rules; 1906-07, machinist and inspr., C.N.R.; 1908 (6 mos.), master mechanic, Hillcrest Collieries Ltd.; 1908 to date, inspr. of boilers, Alberta Govt., Lethbridge, Alta.

References: G. N. Houston, S. G. Porter, H. W. Meech, C. D. MacKintosh, P. M. Sauder.

McLEAN—HENRY JOHN GISBORNE, of Brantford, Ont. Born at Brantford, June 6th, 1888, Educ., I.C.S.; 1904-08, ap'ticeship. in factory and drawing office, 1908-10, in drawing office, and 1910-15, chief dftsman., Waterous Engine Works Co. Ltd. Brantford; 1915-19, overseas, Major, Awarded M.C.; 1919-20, deputy asst. director, Eastern Ontario Dept. S.C.R.; 1920-21, paper making machinery and hydraulic turbines, Dominion Engr'g. Works; At present assisting in the local division Court House.

References: G. E. Bell, G. B. Hughes, C. A. Waterous, C. D. Collins, D. G. Anglin, H. E. Bates, F. C. D. Wilkes.

MITCHELL—FRANK LESLIE, of Iroquois Falls, Ont. Born at Jamaica, B.W.I., June 21st, 1894; Educ., B.Sc., McGill Univ., 1921; Summer 1914 on survey for H.E.P.C., of Ont. at Chippawa; 1915-19, overseas, Lieut. Can Engrs.; 1919 (4 mos.) and 1920 (5 mos.), chemist in charge of manufacture of cane sugar in the British West Indies; June 1921 to date, research dept., service divn., Abitibi Power & Paper Co., Iroquois Falls, Ont.

References: C. M. McKergow, H. M. MacKay, H. M. Lamb, L. E. Kendall, H. G. Acres, W. G. Mitchell.

MOFFAT—WILLIAM JEFFREY, of Regina, Sask. Born at Pembroke, Ont., Feb. 15th, 1887; Educ., Grad. R.M.C. Kingston, 1907; 1908, engr., Nipigon Constrn. Co., 1909-10, instr'man. on constrn., N.T.C. Rly.; 1910-11, instr'man. on location, H. B. Rly.; 1911-15, res' engr., H.B.Rly.; 1915-19, overseas; 1921 to date, asst. engr., dept. of highways, Regina, Sask.

References: H. S. Carpenter, J. W. Porter, G. L. Guy, H. R. MacKenzie, J. Armstrong, A. M. Macgillivray, T. B. Campbell, F. P. Moffat.

NASH—JAMES CUNDIFF, of 105 Mountain Park Avenue, Hamilton, Ont. Born at St. Joseph, Mo., U.S.A., Dec. 14th, 1886; Educ., B.A.Sc., Univ. of Toronto, 1912; 1912 (May-Oct.), engr'g. ap'ticeship. course, Can. Westinghouse Co., and from Oct. 1912 to Mar. 1913, dftsman for same firm; 1913-15, and 1919 (June-Dec.), from record clerk to asst. engr., Hamilton Hydro-Electric System; 1915-19, electrician, with mechanical transport, C.E.F.; 1919 to date, elec. dftsman., Canadian Westinghouse Co., Hamilton, Ont.

References: H. U. Hart, W. F. McLaren, H. B. Dwight, E. R. Gray, S. A. Cummiford, M. B. Watson.

NICHOLSON—THOMAS HERBERT, of 170 Laurier Avenue West, Montreal, Que. Born at Dumfries, Scotland, April 12th, 1881; Educ., private study; 1904-06, telephone tester, Bell Tel. Co., Montreal; 1906-11, chief equipment inspr., New England Telephone & Telegraph Co., Boston; 1911 to date, with Bell Telephone Co., Montreal, as follows:— 1911-14, switchboard engr., 1914-16, equipment standards engr., 1916-20, toll equipment engr., 1920 to date, toll and telegraph engr., at present executive engr., in charge of all long distance, telegraph, testing and asssciated equipment etc., under N.M. Lash, chief engineer.

References: J. E. Armstrong, J. H. Hunter, F. T. Kaelin, P. F. Sise, F. Thomson, A. M. Mackenzie, R. H. Balfour, E. M. Salter, A. Walker.

NUTTING—HAROLD HEDLEY SINCLAIR, of 200 Willard Street, Ottawa, Ont. Born at Ottawa, Aug. 29th, 1887; Educ., Ottawa Collegiate Institute; 1908-09, rly. constrn., O'Brien, Fowler & McDougall; 1909-10, rodman, location and constrn., G.T.R.; 1910-11, foreman, rly. constrn., Foley, Welch & Stewart; 1911-13, instr'man., Dom. Land Survey, Keeso & McLeod; 1914, instr'man. etc. [illegible] charge, Quinze Dam constrn.; 1914-15, instr'man., [illegible] Lake traverse, also Ottawa River and Lake Temiskaming traverse survey; 1915-19, overseas, C.F.A.; 1919 to date, hydrometric recorder, in charge of hydrometric survey party, Dept. Public Works, Ottawa.

References: C. R. Coutlee, S. B. Johnson, A. M. Kirkpatrick, K. M. Cameron, H. M. Davy, R. F. Davy.

RATCLIFFE—WALTER HEPBURN, of 240 King Street East, Kingston, Ont. Born at Toronto, Feb. 24th, 1888; Educ., 3 years Toronto Technical School, 3 years Ontario Architect's assoc. Classes 1907-09; 1909-12, dftng. with J. A. Mackenzie, Toronto, Burke Horwood & White, Toronto and Ellis & Ellis, Toronto; 1912-17, 4 years bldg. supt. for Burke Horwood & White, Architects, Toronto and 1 year with B. H. Prock, Industrial Engrs., Toronto, on industrial plants; 3 years to date, architect and engr. for McKelvey & Birch Ltd., General Contractors, Kingston, Ont.

References: W. P. Wilgar, L. M. Arkley, L. T. Rutledge, W. L. Malcolm, J. M. Campbell.

ROSS—ROBERT BRUCE, of 35 Gerrard Street, London, Ont. Born at Embro, Ont., Sept. 11th, 1881; Educ., Woodstock Collegia te Institute; 1907-14, contractor engr., building bridges, dams etc.; 1914-18, overseas, Major; 1919 to date, Ontario Director, Paving Dept., Milton Hersey Co. Ltd., Montreal.

References: W. P. Near, C. A. Mullen, W. C. Adams, W. C. Miller, H. W. Patterson, C. Talbot.

SELIG—ALONZA CLARENCE, of 24 Pleasant Street, Moncton, N.B. Born at Lunenburg, N.S., Aug. 14th, 1863; Educ., private engr'g. study; 1878, entered service of Intercolonial Rly. as junior and for 10 years engaged as chainman, leveller, and general engr'g. work in office of chief engr., 1888-98, office asst., 1898- 1912, asst. chief engr., in charge of office under chief engr., 1912-15, chief architect in preparing plans and other data for general bldg., constrn., and gen. supervision of constrn. of same. At present, asst. district engr., C.N.R., eastern lines, maritime district.

References: A. F. Stewart, F. B. Tapley, E. G. Evans, S. B. Wass, F. P. Fripp, R. G. Gage, M. J. Murphy, C. S. G. Rogers.

SMALL—HARVEY ARNOLD, of Kingston, Ont. Born at Spencerville, Ont., March 25th, 1887, Educ., B.Sc., Queen's Univ. 1914; 1911 (5 mos); instr'man., Queen Victoria Park, Niagara Falls, Ont.; Spring 1912, levelman, E. D. & B.C. Rly.; 1912-13, asst., paving dept., City of Edmonton; 1914 (May-Aug.), asst., paving dept., City of Edmonton; 1919 (Jan.-July), dftsman and surveyor to C.R.C.E., Mil. Dist. No. 3, Kingston; 1919-21, asst. road engr. to A. L. Baldwin, Kingston-Prescott road, Dept. Prov. Highways; Feb. 1921 to date, res. engr., Dept. Prov. Highways, Kingston Perth.

References: W. A. McLean, G. Hogarth, A. A. Smith, R. M. Smith, D. W. Bews, G. C. Parker.

SNOW—GERALD BRADLEY, of Chicoutimi, Que. Born at Toronto, Ont., Dec. 31st, 1892; Educ., B.Sc., Univ. of Toronto, 1919; 1909-11, topog'r., levelman and nstr'man., Mackenzie Mann & Co.; 1911-12, asst. engr., with A. W. Whitney, surveys, North Railway Co.; 1912-13, levelman and asst. with A. W. Whitney & R. Keemle on rly surveys; 1914-15, officer in charge of engr'g., Kapukasing Internment Camp, under Lt.-Col. F. F. Clarke; 1919-20, asst. engr., surveys, Long Lake Cut, and 1919-21, location and surveys, acting as asst. engr. in charge of work for H. T. Morrison, and asst. engr., of surveys, C.N.R.; 1921 to date, asst. engr., with J. F. Grenon, Quebec Chibougaman Rly., Chicoutimi, Que.

References: H. K. Wicksteed, H. T. Hazen, F. F. Clarke, J. H. T. Morrison, J. F. Grenon, C. R. Young.

SPARK—HARRY S., of 77 Hutchison Street, Montreal, Que. Born at Forfar, Scotland, Nov. 25th, 1891; Educ., Dundee Technical College, Dundee, Scotland, 1908-10; 2½ years ap'ticeship, The Caledon Shipbldg., and Engr'g. Co., Dundee; 1912-14, [illegible] steel bldgs. etc. for Canadian Explosives Ltd., at Parry Sound and [illegible] Vancouver; 1914-17, on Montreal Filtration and Aqueduct Works, [illegible] of hydraulic studies and designs and plans retaining wall and power house at low level pumping station, Montreal; 1917-21, asst. chief dftsman., Canadian Vickers Ltd.; At present asst. to G. E. Vogt., Consltg. Engr., Baltimore, U.S.A., at present in Montreal.

References: F. E. Field, F. Y. Dorrance, F. T. Kaelin, W. Dickson, H. L. Steenbuch, R. W. Mitchell.

SUMMERSKILL—JOHN HENRY, of 804 Shuter Street, Montreal, Que. Born at Portage la Prairie, Man., Aug. 26th, 1892; Educ., B.Sc., (E.E.), 1914; B.Sc. (M.E.) 1915, McGill Univ.; 1915-16, asst. engr., Canadian Marconi Wireless Telegraph Co., and 1916-17, asst. works mgr. for above company; 1918-19, Sub.-Lieut. on constrn. and later of Naval Radio Stations; 1919-20, in charge of purchasing dept. and traffic, Riordon Co. Ltd., Mattawa, Ont.; At present, in charge of the disposal of surplus equipment etc., Riordon Co. Ltd., Montreal.

References: G. L. Freeman, J. T. Farmer, A. K. Grimmer, C. M. McKergow, W. E. Blue, E. S. M. Lovelace.

THOMSON—ALEXANDER, of Lethbridge, Alta. Born at [illegible], Scotland, Aug. 20th, 1891; Educ., Leith Tecnhical School, 1907; 1908-14, 4 years ap-tice, 2 years junior asst., Burgh' Surveyor's Office, Perth, Scotland; 1914-17, dftsman with Western Dom. Rly., Calgary, C.P.R., and C. M. Hoar, D. L. S., Calgary; 1917-18, dftsman and transitman, Calgary South Western Rly.; 1918-19, [illegible] on location C.P.R., transitman, Dom. Govt. Parks Dept.; 1920 to date, dftsman., Lethbridge Northern Irrigation District, Lethbridge, Alta.

References: H. B. Muckleston, C. M. Arnold, F. S. Dyke, H. G. Cochrane, C. L. Dodge.

WEST—ARTHUR ELEMERE, of Walkerville, Ont. Born at Ridgetown, Ont. Oct. 21st, 1886; Educ., Night School and Corres. School; 1908-09, Whitehead & Kales, Detroit; 1909 to date, with Canadian Bridge Company as follows:— 1909-11, struct'l. detailing, 1911-14, checking struct'l. and bridge details, 1914-18, squad foreman, 1918-19, asst. mgr. of constrn., 1919 to date, chief dftsman.

References: G. F. Porter, F. H. Kester, F. C. McMath, S. E. McGorman, G. V. Davies.

WILSON—ELLWOOD, of Grand'Mere, Que. Born at Philadelphia, Pa., U.S.A., Feb. 16th, 1872; Educ., B.A., B.Sc. in chemistry, Univ. of the South, Sewanee, U.S.A., 1893. Postgraduate work, Univ. of Pennsylvania, 1894-96; 1897-1900, constrn. of plantfor Walker-Gordon Laboratory Co. Ltd. of London, England, and manager of the company; 1901-05, private practice, civil engr'g. and surveying, Saranac Lake, N.Y., Holding position of village engr., for that period; 1905- 07, mapping timber limits for Union Bag & Paper Co. Ltd., and Laurentide Co.; 1907 to date, manager of Forestry Division, Laurentide Co. Ltd., Grand'Mere, Que.

References: C. R. Lindsey, J. C. Smith, S. L. de Carteret, H. E. Bates.

WOOLLEY—ARTHUR, of 1824-5th Avenue North, Lethbridge, Alta. Born at Lee, Kent, England, Sept. 3rd, 1884; Educ., 1901-04, Royal Military Academy. 1904-06, School of Military Engineering ,Chatham; 1904-08, 2nd Lieut. and Lieut., Royal Engrs.;1909-11, East Kent Coal Fields Ltd.; 1911-13, asst., Naraquata Tin Mines, Nigeria, West Africa; 1913-14, surveyor, Nordegg Syndicate, Brazean Coal Field, Alberta; 1914-19, military service. Lieut. Royal Engrs.; On return, farming in Alberta until Oct. 1921; At present, statistician, Royal Commission known as Survey Board for Southern Alberta.

References: W. E. Davis, K. Weatherbe, R. S. Lawrence, C. Raley.

WRIGHT—JAMES ALPHEUS, of Montreal, Que. Born at Greenleaf, Mich., U.S.A., May 4th, 1882; Educ., Grad. Cass Tech- High School and Detroit Tech. Institute; 1901-04, jigs and fixtures, Packard Motor Co. foreman final assembles, Ods Motor Works; 1904-06, design and layout of jigs, etc., G. R. Wilson Body Co., Detroit; 1906-08, engr. in charge exp. body, model T. Ford, Ford Motor Co.; 1908-09, engr. in charge jigs and fixtures, G. R. Wilson Body Co.; 1909-1910, chief engr. supt., Buffalo Auto & Trimming Co.: 1910-11, engr. truck dump mechanism, Fitzgibbon & Crisp Co., Trenton, N.J.; 1911-12, asst. chief dftsman., Pope Mfg. Co., West Wks., Hartford; 1912-14, chief engr., Irvin Robbins & Co., Indianapolis; 1914-15, engr. in charge detachable demountable conv. bodies, G. R. Wilson Body Co.; 1915-17, chief engr., prod. mgr., Detroit Weatherproof Body Co., Pointiac, Mich.; 1917-19, chief of misc. section, asst. chief and inspr. of airplanes and airplanes engines, Bureau Aircraft Production, Detroit Division; 1919-21, chief engr., Wright-Fisher Engr'g, Co., Detroit Mich.; At present chief engr., Parker Motor Car Co. Ltd., Montreal, Que.

References: Sir Alex Bertram, A. T. Perrin, C. W. Burroughs, A. L. Morgan, H. V. Brayley.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBERL TO THAT OF MEMBER.

BRAZIER—HENRY ARTHUR, of London, Ont. Born at Windsor, England, Nov. 4th, 1886; Educ., Articled pupil to W. W. Cooper, C.E., Slough, England, 1904-06. Grad. in engr'g., Manchester College of Technology, 1907-08. Member Inst. of Munic. Engrs., Great Britain, 1911; 1906-07, asst. engr'g, Slough, Bucks., under W. W. Cooper; 1908-11, asst. engr., Hale,Cheshire, underS.A. Pickering; 1907-08, chief eng. asst. to Thos. Blagburn, C.E., Altrincham; 1911-12, engr'g. asst., dept. of rlys. and bridges, city engr's. dept., Toronto, Ont.; 1912-14, asst. city engr., and 1914 to date, city engr., London, Ont.

References: C. H. Rust, H. B. R. Craig, W. Chipman, W. A. McLean, J. A. Bell, A. H. Smith, J. E. N. Cauchon.

BUSFIELD—JAMES LEONARD, of Montreal, Que. Born at London, England May 14th, 1888; Educ., B.Sc., (Engr'g.) London University, England; 1907-09, junior asst. to res. engr. — 1909-10, asst. to res. engr. — 1910-12, senior asst. to res. engr., eastern division, G.T.R., Montreal, 1912-14, chief of party and asst. engr. in charge of surveys and tunnel alignment, 1914-15, asst. engr. on special designs, studies and investigations for Montreal Terminals, Mount Royal Tunnel and Terminal Co., Montreal; 1917 to date, principal asst. to Walter J. Francis & Company, Montreal.

References: F. L. C. Bond, F. B. Brown, J. M. R. Fairbairn, W. J. Francis, G. G. Gale, R. W. Leonard, A. Surveyer, W. F. Tye, H. K. Wicksteed.

CORNELL—CHARLES WALTER, of 531 Runnymede Road, Toronto, Ont. Born at London, Ont., March 14th, 1880; Educ., Grad. in C.E., Univ. of Toronto, 1911; 1902-07, install'n., operation and matce of power plant equipment, Toronto Railway Co. and Scarboro Beach Park Co., Toronto, Ont.; 1908-09 (summers), 1st asst., survey party, Dept. Indian Affairs, and electrician, Cobalt Hydraulic Power Co.; 1911-12, waterworks dept., City of Vancouver; 1912-13, supt., B.C. Granitoid and Contracting Co., Vancouver, B.C.; 1913-15, mgr., Jones-Cornell Constrn. Co., Engrs. and Contractors, New Westminster, B.C.; 1915-16, supervisor of inspection, Canadian Inspection and Testing Labs.; 1916-17, testing engr., Imperial Ministry of Munitions (Hamilton District); 1917-18, district inspr., shrapnel forging, Imperial Ministry of Munitions (Toronto District), 1918-19, charge of testing and heat-treating plant. British Forgings Co., Toronto; 1919 to date, district engr., of County roads, province of Ontario.

References: W. A. McLean, R. C. Muir, T. H. Byrne, A. K. Hay, C. R. Young, P. Gillespie, F. B. Goedike, J. G. Cameron.

DALLYN—FREDERICK ALFRED, of Spadina House, Spadina Avenue, Toronto, Ont. Born at Hamilton, Ont., June 7th, 1886; Educ., B.A.Sc., Univ. of Toronto, 1909-10, estimating and designing reinforced concrete, Bishop Constrn. Co.; 1910-13, engr. in charge of experimental station, Prov. Board of Healyh of Ontario; 1913-16, Consultant, International Joint Commission re pollution of Boundary waters; 1913 to date, provincial sanitary engr. and director of engr'g. divn., Prov. Board of Health of Ontario. 1917-21, chairman, Committee on Sewage and Sanitation, Am. Soc. of Munic. Improvements, 1920-22, lecturer in sanitary engr., Institute of Public Health, London, Ont.

References: G. H. Ferguson, C. A. Magrath, C. H. Mitchell, R. S. Weston, H.E. T. Haultain, R. W. Leonard, A. F. Macallum, F. S. Keith.

PHILIP—PATRICK, of 94 Linden Avenue, Victoria, B.C. Born at Londonderry, Ireland, Dec. 4th, 1882; Educ., 1897-1900, night classes Londonderry Technical Institute.; 1898-1903, pupil with J. J. S. Barnhill, A.M.E.I.C., Londonderry, and 1903-07, asst. to above; 1907-10, location and constrn., G.T.P. Rly.; 1910-17, asst. to city engr., Vancouver, B.C.; 1917-19, dist. engr., Dept. P.W., Kamloops, B.C. in charge engr'g. dist. No. 3; 1919-21, dist. engr., Vancouver, B.C., dist. No. 2; 1921 to date, public works engr., Prov. of British Columbia.

References: J. E. Griffith, W. H. Powell, A. E. Foreman, G. P. Napier, A. Lighthall, F. L. Macpherson, C. Brackenbridge.

ROUTLY—HERBERT THOMAS, of Toronto, Ont. Born at Lindsay, Ont., Jan. 20th, 1878; Educ., Grad. S.P.S. Univ. of Toronto, 1906, O.L.S. 1907, D.L.S. 1908; 1900-03, asst. engr. in charge of office work, Kirkfield section of the Trent Canal; 1904-05 (summers), location and constrn. work, C.N.R.; 1907-17, private practice as land surveyor and civil engr., Haileybury, Ont.; 1908-11, town engr., Haileybury; 1908-13, engr. for township of Coleman; 1913-19, general contracting; 1920 to date, private practice as contractor, Toronto, Ont.

References: H. K. Wicksteed, W. A. McLean, P. Gillespie, C. H. Fullerton, F. Barber, A. E. Jupp.

SHARPE—ALBERT ERNEST, of Leader, Sask. Born at Palmerston, Ont., Jan. 28th, 1877; Educ., Private study; 1897-1900, minor positions with Northern Pacific, Lake Manitoba Rly., and Canal Co. and C.P.R.; 1901-1915, with the C.P.R. as follows:— 1901-04, transitman and res. engr., 1904-07, res. engr., 1907-10, asst. engr., 1910-15, reconnaissance engr., western lines, 1915 (Mar.-Sept.), asst. engr.; 1917, made reconnaissance and located line, Selkirk to Rice Lake Gold Fields for President, Central Canada Rly. and Power Co.; Aug. 1918 to date, asst. engr., C.P.R., Winnipeg.

References: W. F. Tye, J. G. Sullivan, W. A. James, J. R. C. Macredie, A. McCulloch, J. Callaghan.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

BELANGER—JEAN LOUIS CLOVIS, P. O. Box 11, Lauzon, Que. Born at Carleton, Que., Sept. 27th, 1889; Educ., Quebec Seminary., I.C.S., Private tuition; 1907-11, tapeman on constrn. and 1911-14, asst. res. engr., T.C.Rly.; 1914-15, in charge of constrn. Charny Water Works; 1915-17, with Quebec Streams Commission as follows:— transitman on topog'l. survey of Lake St. John — 1915-16, instr'man. for accurate survey of flooded lands, Lake St. Francis — 2 mos. asst. res. engr. on constrn. of storage dam, Lake St. Francis — 5 mos. in charge of survey of St. Maurice River Reservoir — 1916-17, in charge of various surveys and lake inspections; — also in charge of telephone line constrn. and of foundations of St. Maurice Storage Dam; 1917-19, in charge of constrn. of Davie's Shops and Shipyards for Jos. Gosselin Ltd., of Levis; 1919 to date, asst. engr., divn. engr's. office, C.N.R., Levis, Que.

References: J. E. Gibault, J. N. R. Beaudet, A. O. Bourbonnais, J. B. D'Aeth, A. R. Decary, A. Amos, O. O. Lefebvre, L. C. Dupuis.

DAVIES—DAVID CECIL MINES, of 2603 McTavish Street, Regina, Sask. Born at London, England. April 4th, 1892; Educ., 1906-08, mech. engr'g. course, Technical College, London, England, 1908-12, mech. engr.'g. course, London Polytechnic Institute, evening classes; 1908-12, asst. in drawing office of Sir Geo. Marks, Consltg. Engr., London, England; 1912-16, inspr. of publicworks, Prov. Govt. of Sask.; 1916-19, overseas; 1919-22, asst. engr. on design and supervision of constrn. of reinforced concrete, steel and timber, Dept. of Highways, Govt. of Sask., Regina.

References: H. S. Carpenter, C. W. Dill, J. M. Patton, D. A. R. McCannel, A. N. Ball, H. R. MacKenzie.

FLETT—FRANK PARKIN, of 57 Moy Avenue, Windsor, Ont. Born at Chatham, N.B., Nov. 24th, 1892; Educ., B.Sc. Univ. of N.B. 1914. 1 year special work Mass. Inst. of Tech. 1919-20; Rodman dftsman, etc., during vacations; 1915-17, voerseas. Lieut. Can. Engrs.; 1918-19, dist. vocational officer (various locations in Ontario), in charge of re-education of soldiers, etc.; 1920 to date, engr., sales engr. etc., and at present mgr. sash and engr'g. dept., Trussed Concrete Steel of Co. Canada, Walkerville, Ont.

References: H. E. T. Haultain, H. W. D. Armstrong, G. Stead, H. C. McMordie, A. J. Riddell, N. Wilson, R. P. Rogers, J. A. Stiles.

GOULET—SIFROY, of Peterborough, Ont. Born at Holyoke, Mass., U.S.A., May 8th, 1891; Educ., Grad. Mount St. Louis Scientific Course, 1910; 1910-16, dftsman mech. engr.'s office, and 1916 to date, chief mech. dftsman and asst. to mech. engr., Can. Gen. Elec. Co., Peterborough, Ont.

References—J. A. G. Goulet, B. L. Barns, A. B. Gates, J. Barnes, C. E. Sissons, R. L. Dobbin.

LeBLANC—PIERRE MAXIME HENRI, of 120 Wurtemburg Street, Ottawa, Ont. Born at Montreal, Que. Oct. 1st, 1884; Educ., C.E. Laval Univ., 1908; D.L.S.; 1908 (4 mos.), asst. engr. on constrn. of lighthouse, St. Lawrence River; 1908-12, asst. engr., tidal and current surveys, Dept. Naval service; 1912-14, asst. with P. R. A. Bélanger, inspr., D.L.S., in Western Provinces; 1914 to date, in charge of parties, topog'l. surveys branch, Dept. Interior, Ottawa.

References: W. B. Dawson, G. H. Herriot, C. Rinfret, R. C. Purser, E. M. Dennis, F. V. Seibert, P. E. Palmer.

McDONALD—NORMAN GEDDES, of Oshawa, Ont. Born at Cresswell, Ont. Aug 4th, 1893, Educ., B.A Sc., Univ. of Toronto, 1918; 1916-17 (summers), machine work, Metal Products Co., Peterborough; 1918 (May-Nov.), asst. chief inspr. of steel at British Forgings Ltd., Toronto, for Imperial Ministry of Munitions; 1918-19, dftsman, transitman etc. in constrn. of extension to Ontario Power Co. Plant at Niagara Falls for H. E. P. C.; Sessions 1919-20 and 1920-21, demonstrator and instructor in Hydraulics, Univ. of Toronto; April 1921 to date, town engr., Oshawa, Ont.

References: W. Storrie, J. J. Traill, P. Gillespie, S. Shupe, G. F. Hanning, W. Jackson.

McKNIGHT—ROBERT CLELAND, of 352-8th Street West, Owen Sound, Ont. Born at Owen Sound, Ont., May 25th, 1886; Educ., Grad. R.M.C. Kingston, 1906, 3rd year Science, McGill Univ., Class 1908; B.C.L.S., 1914; 1907-08, asst. engr. on constrn., N.T.C.Rly.; 1911-12, in charge of party on survey of Port Edward Townsite, B.C.; 1912, in charge of investigation of power, dam failure near Seattle; 1912-14, in charge of exploration survey, topog'l. survey and location survey of Ritchie Agnew Power Co., at Alberni, B.C.; 1914, in charge of party on govt. land survey on Queen Charlotte Island; 1914-19, overseas, Major, C. F.A.; At present, county engr., Grey County, Ont.

References: G. L. Mattice, H. St. J. Montizambert, J. M. Rolston, E. C. Goldie, H. L. Bucke.

ROUNTHWAITE—FRANCIS GEORGE, of Tucker's Town, Bermuda. Born at Collingwood, Ont.; April 3rd., 1892; Educ., B.Sc., (C.E.), McGill Univ. 1916; 1909-10, rodman, J. S. Metcalf Co. Ltd.; 1913-14 (summers), rodman and instr'man. on constrn. Algoma Central and Hudson Bay Rly.; 1916-19, overseas, Lieut., C.G.A.; 1919 (Apr.-Aug.), asst. engr., Magwood & Stidwell, Munic. Engrs., Cornwall, Ont.; 1919-20, Atlas Constrn. Co., Montreal; 1920-21, office engr., under J. B. Berry, Grand Trunk Valuation; Aug. 1921 to date, gen supt., The Bermuda Development Co., a subsidiary company of Messrs. Furness Withy Co., London, England.

References: W. McNab, J. H. Trimingham, G. M. Stewart, J. B. Wain, A. S. Going, W. H. Magwood, F. L. C. Bond.

RUST—FREDERICK CHARLES, of 90 Albany Avenue, Toronto, Ont. Born at Toronto, Sept. 24th, 1888; Educ., 3 years App. Sc., Univ. of Toronto; 1907-08 (summers), rodman etc., City of Toronto; 1909 (summer), engr'g. ap'tice course, Canadian Westinghouse Co., Hamilton, Ont.; 1910, inspr., hydro-elec. dept., City of Toronto; 1911 (summer), machine shop, City of Toronto; 1911-12, instr'man. and road despatcher, Appalachian Power Co., Virginia, New River Development; 1912-14, asst. to engr'g. supt., B.C. Electric Railway Co., Victoria, B.C.; 1915-19, overseas; 1919-20, bldg. surveys for H. H. Williams Co., Toronto; 1920-21, roving checker, Toronto Harbour Commissioners; Feb, 1921 to date, asst. to res. architect, Toronto Harbour Commissioners, Toronto.

References: C. H. Rust, A. C. D. Blanchard, M. V. Sauer, E. L. Cousins, J. G. R. Wainwright, G. T. Clark.

WOOD—GEORGE HOWARD, of 20 Cayuga Street, Ottawa, Ont. Born at Kincardine, Ont., May 12th, 1894; Educ., B.A.Sc., Univ. of Toronto, 1917. Post grad. work at Manchester Univ., Jan.-June 1919; 1913 (summer), with Kincardine Municipal Electric Light and Power Plant; 1914 (Season), junior asst. and 1915 (season) instr'man., reconn. survey of Carrot River Triangle Drainage Project, North Manitoba; 1916 (season, asst. to G. G. McEwen, Dom. Water Power surveys in Manitoba; 1917-19, overseas, Lieut., Can. Engrs.; 1919-20, junior power devel. engr., Dom. Water Power Branch — office work; May 1920 to date, asst. hydraulic engr., Reclamation Service, Dept. of the Interior, Ottawa, Ont.

References: J. S. Tempest, G. F. Richan, G. F. Horsey, J. T. Johnston, T. H. Dunn, G. G. McEwen, H. R. Cram.

FOR TANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

CAMPKIN—WILBERT LEE, of 2136 Angus Street, Regina, Sask. Born at Indian Head, Sask., Dec. 10th, 1896; Educ., special course in telephone engr'g., Los Angeles, 1917-18; 1916-19, with Southern California Telephone Co., Los Angeles, on constrn. and mtce. of automatic telephone central office equipment; 1919 to date with Sask. Govt. Telephones, on constrn. and mtce of automatic telephone equipment also asst. in design and mtce., and at present, head switchman (asst. wire chief).

References: W. R. Warren, H. B. Sherman, S. R. Parker, C. W. Dill, L. A. Thornton

GAGNON—ALBAN, of 26 Buckingham Avenue, Montreal, Que. Born at Montreal, Sept. 26th, 1892; Educ., C.E. Ecole Poly. Montreal, 1915; 1912, meterman, Ottawa Public Works; 1913, instr'man for F. C. Laberge; 1914, instr'man., Ottawa Public Works; 1915, road, engr., Quinlan & Robertson., asst. engr., Town of Pointe aux Trembles; 1916-17, Canadian inspection — component parts inspection in New England States; 1917 (Mar.-Aug.), asst. engr. on constrn., British Chemical Co., Trenton, Ont.; 1917-18, shell inspr.; 1919-20, divisional engr., Quebec Roads Dept.; Aug. 1920 to date, highway engr., Leger & Charlton Ltd., Lachine, Que.

References: R. M. Charlton, F. C. Laberge, J. O. Montreuil, A. W. Sullivan.

HALL—JOHN SMYTHE, of 660 Oxford Street, London, Ont. Born at Montreal, Que., Jan. 27th, 1894; Educ., B.Sc. McGill Univ., 1914; ap'tice and fitter, C.P.R.; 1911-20 less college sessions and overseas service) with C.P.R., 1920 (Feb.-May), night locomotive-foreman, Sherbrooke, Que., 1920-21, shop foreman, Farnham, Que.; Sept. 1921 to date, night locomotive foreman, C.P.R., London, Ont. (4 years overseas Lieut. Rly. Constrn. Corps).

References: F.B. Brown, A.F. Byers, F.S. Keith, C.M. McKergow, A.R. Roberts.

MacINTYRE—W. BRYCE, of 245 Lauder Avenue, Toronto, Ont. Born at Avon, Ont., Oct. 18th, 1894; Educ., B.A.Sc., Univ. of Toronto, 1919; 4 mos. in charge of Sewer layout with the Du Pont Engr'g. Corpn. Flint, Mich.; 2 years to date, in charge of sewer design with Barber, Wynne-Roberts & Seymour, Toronto.

References: R. O. Wynne-Roberts, J. S. Galletly, E. V. Deverall, G. R. Jack, O. M. Falls, A. R. Black, J. G. Jack.

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VOLUME V MONTREAL, APRIL 1922 NUMBER 4

The Lignite Briquetting Plant, Bienfait, Sask.

Importance of developing lignite as commercial fuel in Western Canada, research work by Lignite Board, details of experimental work.

E. R. Woodward, Jr.E.I.C.

Paper Awarded Students' Prize, 1921

At a recent sitting of the United States Senate, referring to national coal consumption, Senator Calder, Chairman of the Committee on Reconstruction and Production, said:

"The waste alone in burning raw coal makes us stand aghast, perhaps another generation will have the foresight and courage to obtain the full value from each pound of coal."

This utterance is typical of the views held by the most far sighted present day economists. That the Canadian Government is fully alive to these facts is proved by the erection of the Lignite Briquetting Plant just completed in the Souris coal mining area of Southern Saskatchewan. The object of the plant is to make possible the efficient utilization of the vast low grade lignite resources of the Canadian Middle West.

Historical Note

In the year 1852, Hugh Sutherland, now Chairman of the Western Dominion Collieries, while on a prospecting trip in Southern Saskatchewan, heard strange stories from the Indians of the district about a place known to them as the "Valley of Fire".

On investigation of this alleged phenomenon the ground itself was actually found to be blazing in patches of considerable area along the valley of the Souris River. Mr. Sutherland's guides assured him that these fires had

burned continuously, winter and summer, for many years. The white man's conclusion was that he had thus most unexpectedly discovered surface outcroppings of coal. He immediately sent word to Government authorities at Winnipeg of the discovery of coal in Southern Saskatchewan only to be ridiculed by them for his trouble. Having the courage of his convictions, however, he spent the winter building a barge. In the spring of the following year when the frost had been thawed from the ground sufficiently to make digging possible he filled his barge with the new found coal, and commenced a five hundred mile journey via the Souris and Red Rivers to Winnipeg.

Such was the signal which precipitated an extensive migration of prospectors to the Souris district, and today lignite mines in great numbers rear their blackened tipples skywards throughout this part of the country.

Lignite Coal

Lignite is a low grade coal, which, in its natural state, is by no means an ideal fuel, either for domestic or commercial purposes. In the Middle West of both Canada and the United States it has been used extensively for many years on account of its abundance and consequent cheapness.

Following are some of the most marked objections to the use of raw lignite coal as a fuel:—

(1) It has a high moisture content, 30% to 35% (Anthracite contains from 1% to 5% of moisture). This increases the cost of transportation since the great amount of "water of composition" is later evaporated at the expense of the heat value of the coal itself.

(2) Lignite is a friable material. It is only suitable for fuel when freshly mined, as it disintegrates rapidly on exposure to the air.

(3) It has a low calorific value, 6,600 to 7,000 B.T.U's. per pound. Anthracite gives 12,000 to 12,800 B.T.U'S. per pound.

Work of the Lignite Board

The object of the Lignite Utilization Board of Canada is to overcome these difficulties by subjecting the coal to a process of low temperature carbonization, and then briquetting the residue. This carbonized lignite is in the form of a coke or charcoal, which, when mixed with some binding material, such as tar, or sulphite pitch, can be readily made into briquettes. These briquettes have been shown by experiment to have:

(1) A low moisture content, 0% to 6%.

(2) Great compressive strength.

(3) Ideal storage qualities: for example they do not deteriorate in contact with the air.

(4) A high calorific value, 11,500 to 12,000 B.T.U's, approximating that of anthracite coal.

In short, the low temperature carbonization method of making briquettes as carried on at the Bienfait plant demonstrates a method of converting very low grade coal into a fuel of the highest quality.

Experiments made at Ottawa on a semi-commercial scale have shown that 2¼ tons of Souris lignite yield one ton of briquettes. Coal experts throughout the whole North American continent are looking to the new plant in Southern Saskatchewan for proof that this important chemical experiment can be made a commercial success.

Lignite Deposits

A recent article in the "Scientific American" gave the following data on lignite coal:—

"Underlying the province of Saskatchewan and reaching Southward into the United States are immense deposits of poor lignites. These beds cover more than 13,000 square miles, and are estimated to hold 58,812,000,000 tons of the fuel. The lower seam of these lignites is deemed commercially the more important, for it attains a thickness of 8 feet, yielding 11,000 tons per acre, or substantially 10,000,000 tons to the square mile. Better lignites and bituminous coals occur in Alberta."

The great importance to Canada of the utilization of her Saskatchewan lignites is emphasized by the fact that the whole country, from the bituminous coal deposits of the Maritime provinces to those of Alberta and British Columbia, is devoid of coal other than these low grade lignites.

As a result of this dearth of good coal in the Middle West, and also the absence of any considerable amount of anthracite in the Dominion as a whole, Canada today imports 50% of her coal supply from the United States. The Canadian consumer is thus compelled to pay a very high price for his fuel.

Under these conditions it is at once apparent that the successful utilization of the enormous reserves of Western lignite is of paramount importance to Canada. The day may not be far distant when the United States will discontinue their present large exports of coal to this country. Now is the time therefore for the Dominion to make herself self-supporting in the matter of her fuel supply, and the opening of the new plant at Bienfait is, we hope, the dawn of that era of independence.

Creation of the Lignite Utilization Board

Researches on lignite were commenced early in 1917 by the chemical staff of the Fuel Testing Division of the Mines Branch, Department of Mines, Ottawa. In the summer of 1918 the Lignite Utilization Board of Canada was created by an Order in Council of the Dominion of Canada, supplemented by an agreement as to finances with the provincial Governments of Manitoba and Saskatchewan. The Board immediately made a series of laboratory investigations at the Fuel Testing Station of the Mines Branch, carrying on and completing the work already commenced.

Erection of the Plant

In the summer of 1920 work was commenced at Bienfait, the location surveyed, and the ground prepared for

the erection of the plant. Passing over the earlier stages of construction, let it suffice to say, that by May 1921 all the main buildings, and the greater part of the work were finished.

The two chief items of equipment yet to be installed were:

(1) The piping; steam, gas and water.

(2) The conveying machinery.

Some details of these will now be given, together with a description of the power house.

Power House

In the boiler room are three horizontal return tubular boilers, each of 150 B.H.P. capacity; grates suitable for burning lignite coal. The rated working pressure is 165 lbs. gauge. The boilers are connected to the main steam line by 8 inch high pressure wrought iron pipe with flanged joints, suitable reductions being made for the steam lines to the various engines.

Following are details of the power units in the engine room:—

(1) A 400 K.W. Robb Armstrong Corliss engine in direct connection with an alternating current generator having a capacity of 600 volts, 384 amps., 150 R.P.M.

(2) A Westinghouse automatic compound engine with alternating current generator; 100 K.W., 600 volts, 96.2 amps., 3 phase, 60 cycles, 300 R.P.M.

(3) A Westinghouse standard engine with direct current generator, used as an exciter to the two larger units. Capacity: 25 K.W., 125 volts, 200 amps, 375 R.P.M.

Conveying Machinery

The conveying machinery installed at the plant falls under the following four heads:—

(1) Bucket elevators.
(2) Steel apron or "finger and flight" conveyors.
(3) Belt conveyors.
(4) Screw conveyors.

Bucket Elevators

These consist of endless chains provided with "V" shaped steel buckets spaced at short equal intervals. The steel casings are built in sections, and are provided with inspection doors at the base.

Apron Conveyors

The steel apron consists of two strands of roller chain between which are bolted double beaded steel flights. These flights overlap, thus making a tight apron. The flights are provided with steel ends which, in conjunction with the apron, form a continuous moving trough. The corrugated effect of the double beaded flight serves as a check against the flow of the material when the apron is inclined.

Belt Conveyors

The three pulley carrier has three outside troughing pulleys, and a central pulley which revolve on three separate spindles. The contour of the spindles in the assembled carrier thus approximates the troughing contour of the belt, thereby permitting of no wear due to slipping. For carrying coal the maximum speed of a 10 inch belt conveyor should be about 250 feet per minute.

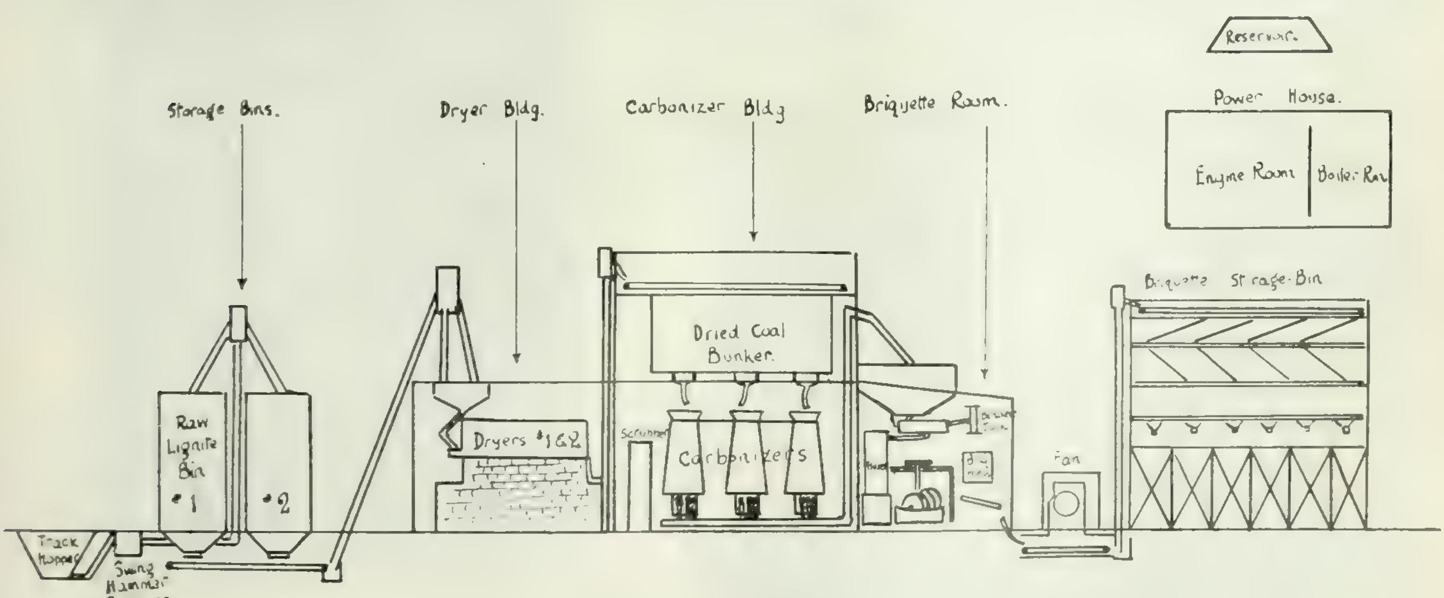

Figure 1. Flow Sheet.

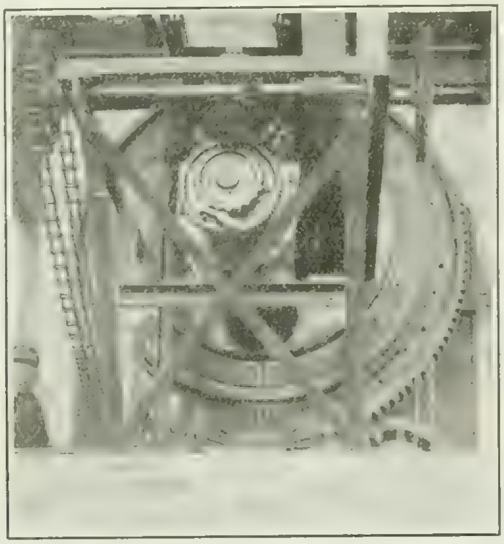

Figure 2. Dryer Mechanism.

Operation

The flow sheet will serve to illustrate the following general description of the plant, and the process involved.

The raw lignite is first dumped from incoming railway cars into the track hopper, whence it is carried by an inclined steel apron conveyor to a swing-hammer crusher (details of the crusher are given later). This pulverizes the coal to a maximum size of $\frac{1}{8}$ inch diameter.

A vertical "V" bucket conveyor raises the crushed coal to the top of the two storage bins into which it is allowed to fall. Each of these bins has a conical shaped floor which converges at a 60 degree angle to a small discharge spout in the centre. A belt conveyor carries the discharge to the foot of an inclined bucket conveyor which elevates the crushed raw coal to the bins over the dryers. From these bins the coal is fed through a chute and screw conveyor into the dryers.

Drying the Lignite

The two dryers are huge steel cylinders, each one weighing 40 tons, length 65 feet, diameter 6 feet. They rotate on inclined axes; this affords a gravity discharge of the dried coal at the rear end. Angles are rivetted longitudinally inside the shells, their effect being to lift the coal and stir it up as the dryers rotate. This stirring process assists dehydration. The dryers are heated by hot gases from the downtake of the carbonizers. A furnace is also provided under the feed end to act as an auxiliary heater or to be used when starting up the plant. The dryer cylinders are built in four quadrants. The object is to increase the heating surface by giving the hot gases free access to all parts of the shell.

Feed to Carbonizers

The dried coal leaves the rear end of the dryers by screw conveyors, it is then elevated in a vertical bucket conveyor to a horizontal screw conveyor which feeds the coal into a large bunker above the retorts. It may be noted that in cross section this bunker has the shape of the catenary curve; the shape affords cheap construction and is well suited to requirements. An objection to the design is that the bunker has a capacity many times greater than the carbonizers can take care of.

Carbonizing Retorts

The coal is fed through a flexible spout into the carbonizing flues of the inclined retorts. These flues have iron baffles projecting downwards at regular intervals to insure an even depth of coal throughout the whole flue, and to stir the coal during its passage downward. This depth is only $1\frac{1}{2}$ to 2 inches, the object being to have the whole of the charge as near as possible to the heating surface. The latter consists of carbofrax slabs which form the base of the carbonizing flue. In this way uniform heating of the whole mass of coal is obtained, a feature necessary to effective carbonization.

A temperature of about 600° C., has given the best results in experiments made to date. Whether or not that same temperature will prove to be satisfactory with these commercial size carbonizers is a point to be decided after the plant has been in operation for some time.

The 45 degree slope of the carbonizing retorts is slightly steeper than the natural angle of slope of the powdered lignite, and gives rise to a slow gravity flow of the coal down the carbonizing flue into the discharge hoppers.

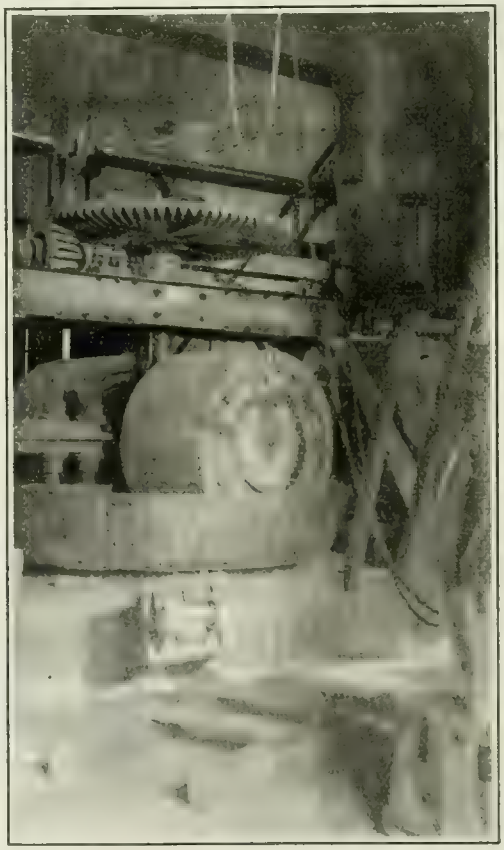

Figure 3. Chilian Mill and Fluxer

Discharge from Carbonizers

The discharge hoppers are air tight. Inside they have a jet which sprays cold water on the hot residue before it passes through to the screw conveyor. Each hopper is fitted with a pyrometer for temperature control. The gate valves on the hoppers have to be calibrated by trial in order to determine the rate of discharge which will give the most complete carbonization. This is a point at which chemical control plays a very important part.

The carbonized residue now travels by a screw conveyor, then by a "V" bucket elevator to a large bin above the briquette room.

Addition of Binding Material

From the bin just mentioned the carbonized residue runs into a mixer. At the same time a definite proportion of tar or sulphite pitch is added from a small tank. The mixer is a large horizontal trough, about 10 feet long and 18 inches wide, containing a special screw conveyor fitted with helical blades which give a mixing motion to the residue and pitch.

The mixture now passes into the fluxer: a vertical cylinder, about 12 feet by 4 feet, fitted with arms which rotate on a central shaft. The rotating arms mesh with stationary arms which project inwards from the sides of the shell.

The next unit is a special Chilian mill which is intended for use *not* as a crusher but as another mixer.

Making the Briquettes

After further treatment in another horizontal mixer, the coal is elevated and passed through the briquetting press: two heavy rollers indented with small egg shaped cavities. The briquettes are discharged on a shaking bar screen which separates the fines. This dust falls on an apron conveyor which returns it to the press, and thus obviates waste.

From the bar screen the hot briquettes are discharged to the cooling conveyor: a steel apron or "finger and flight" conveyor which runs along a tunnel under the floor of the briquette room, and to the foot of a bucket elevator outside the building. A large fan driven by a motor supplies a cold blast of air to the cooling conveyor.

The cold briquettes are elevated to the top of the storage bins, where a belt conveyor carries them along to be dropped through openings into the bin below. A railway track enables cars to be loaded with briquettes from chutes in the storage bin. The full cars are then weighed on the track scales, and shipped out for distribution.

Following the above general account of the plant, a more detailed description will now be given of:—

(1) The Crusher
(2) The Carbonizer.
(3) The Gas Scrubber.

The Swing Hammer Crusher

A crusher of this type is adjacent to the track hopper the raw lignite is fed into it by an inclined apron conveyor. The coal is reduced by being struck while in suspension. It enters the machine near the top, and, in falling comes in contact with the rapidly revolving hammers which drive the lumps of coal against the breaker plates. From these plates the particles rebound again into the path of the hammers.

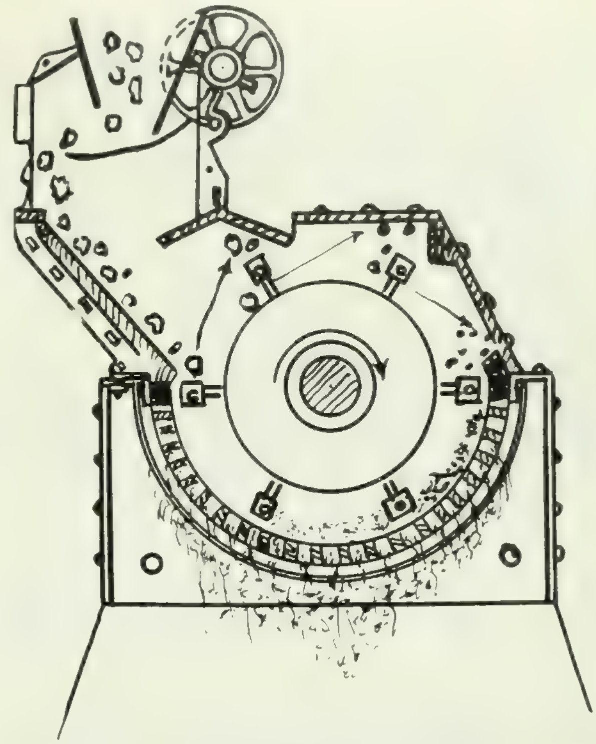

Figure 4. Swing Hammer Crusher.

Fineness is to a large extent determined by the intensity of the blow, hence different degrees of reduction may be had by varying the peripheral speed of the hammers. Coal fed from above falls down a sloping breaker plate where it is engaged by the rapidly revolving hammers. The partially reduced material passes over the cage of screen bars, and all that is sufficiently fine falls through. The residue is carried round the machine for a second operation. The hammers are made of manganese steel, and are double ended so that they can be reversed end for end when worn. Provision is made for removing and replacing the hammers through a door in front.

The best results are obtained when the coal is dry, and in lumps not greater than 3½ inches diameter; with the hammers revolving at 1,000 to 1,200 R.P.M.

Carbonization

Experiments on the carbonization of Western lignites were carried out by Messrs. Stansfield and Gilmour. An account of their work appeared in the "Transactions of the Royal Society of Canada",1918, vol. XII, and is as follows:

"The apparatus designed for these tests embodies three important features:—

(1) An accurate temperature control.

(2) The reduction, as far as possible, of the temperature lag from the walls to the centre of the charge.

(3) The complete removal and easy collection of the tar vapours.

"The temperature control is effected by the use of an electrically heated lead bath B, with suitable thermal insulation. The bath rests on a moveable platform which

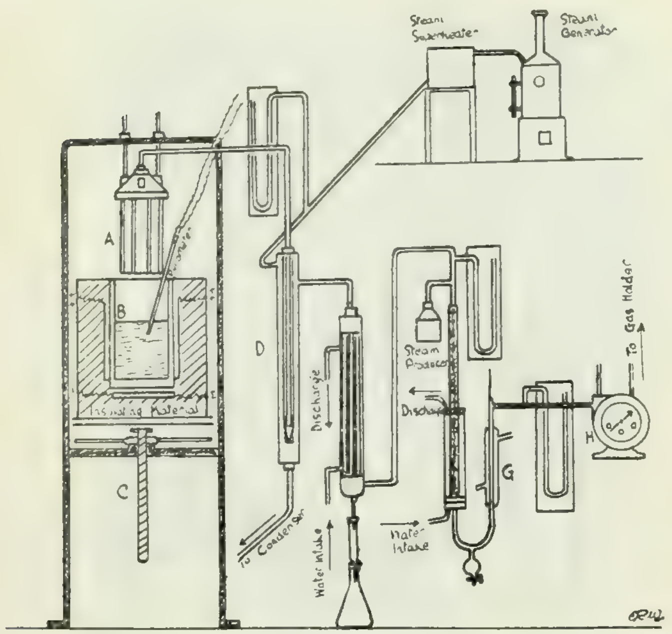

Figure 5. Apparatus for Lignite Carbonization.

can be raised by a screw C. The temperature is observed by means of a pyrometer, and regulated by switches and a rheostat.

"The reduction of lag is brought about by the use of a tubular retort A. This consists of 7-12 inch lengths of 2 inch boiler tubing mounted into a common cast iron head. No part of the charge is thus more than 1 inch from the walls of the retort.

"The method employed for the collection of the tar is as follows:—The hot gases leaving the retort pass down through the centre tube of a small scrubber D made of iron pipe, and containing three interlacing coils of wire passing up again through a surrounding annular space, the whole being jacketted with superheated steam. The heavy tar oils are here condensed in a practically water-free condition, and drop into a weighed glass beaker. The lighter oils, steam and gases pass on and down through a simple tubular condenser, where the two former condense and collect in a receiver. The oils float on the water, showing only a slight tendency to emulsify.

"The coal gases leaving the condenser still contain some tar fog. They are therefore passed down through a tube scrubber filled with glass beads (and a short layer of glass wool shown shaded in sketch), through which a jet of stream from a weighed boiler is also passed. The bottom half of this scrubber is water cooled. It completely removes the tar fog from the gas. The oil first condensed on the beads acts as an oil scrubber, collecting more of the tar. The steam prevents the clogging of the scrubber by keeping the tar hot and fluid, also when condensing at the bottom it carries down with it any vapours still remaining. The gases are thus completely cleaned, and all the liquid products as well as the ammonia from the lignite are collected in the vessels, and can be redistilled without excessive bumping or frothing, The gases leaving the scrubber F pass through a final cooling tube G, through a gas meter H and into a gas holder."

Design of Commercial Carbonizer

Following further investigation along the lines indicated above, Edgar Stansfield, M.E.I.C., in January 1921 contributed an article to the Journal of Industrial and Engineering Chemistry of which the following is an excerpt:—

"The design of the carbonizing retort consists essentially of a strongly heated surface or retort floor inclined at an angle of 45 degrees, slightly steeper than the angle of repose of the crushed lignite. The material to be treated flows down the heated surface from a hopper at the top passing under a succession of baffle plates which control the thickness of the layer. The rate of flow of the material is controlled entirely by the rate of withdrawal from the bottom of the retort.

The retort is suitably enclosed at the sides and top; gas offtakes are provided in the cover. The thickness of the layer is controlled by the difference between the slope of the retort and the angle of repose of the coal; by the distance between successive baffles, and by the clearance between the baffles and the retort floor. The material is stirred repeatedly by its passage under the baffles.

The heated surface may be heated from below with gas. It should be hottest at the bottom of the retort and progressively cooler towards the top.

The regulation of the degree of carbonization of the lignite is entirely controlled by the time of its passage through the retort, that is, by the rate of withdrawal from the bottom."

The Gas Scrubber

A centrifugal scrubber is used to recover the coal tar from the gases given off by the lignite during carbonization. The washing medium is fed in at the top, and is carried by means of the bevel division plates into the distributing cone, where it is immediately driven by centrifugal force through the deflectors in the form of a fine spray. The deflectors rotate at a speed of about 350 R.P.M. As the drops of hot water travel with high velocity from the points of the deflectors, they strike the side of the scrubber with a strong impact, rebounding at an angle, and so causing more intimate contact with the ascending gas. The washing medium passes from plate to plate, and from cone to cone. As the shaft revolves the deflectors have a sweeping effect imparting to the gas a centrifugal motion, and thereby increasing its length of travel

Utilization of By-Products

For the present it is not proposed to develop the by-products from the lignite at the Bienfait plant. The offcoming gases, however, are used as a fuel under the carbonizing retorts. Those gases are first passed through the scrubber which removes the mechanically carried particles of tarry acid. They are then fit for fuel. The calorific value of the gas averages above 400 B.T.U's. per cubic foot and more than enough gas is volatilized during the carbonization of one ton of lignite than is required to carbonize the next ton.

Chemical Control

No description of the plant would be complete without a reference to the work done in the chemical laboratory, and its important rôle in the direction and control of the whole process.

Sampling

A representative sample is taken of each car load of coal as it comes in from the mine. It is first taken to the sample room where it is crushed in three stages:—

(1) Small size Gates jaw crusher.
(2) Coffee mill.
(3) Abbé standard laboratory ball mill.

The sample is then quartered through a riffle, put into an air-tight labelled bottle, and taken to the laboratory. It is now ready for analysis.

Analysis

The following analytical determinations are made on the raw coal samples:—

(1) Moisture
(2) Ash
(3) Volatile hydrocarbons
(4) Calorific value.

Fixed carbon is estimated by difference: the sum of the percentages of moisture, ash, volatile matter and fixed carbon being 100. The fuel ratio $= \frac{\text{F.C.}}{\text{V.M.}}$ and it furnishes a good indication of the quality of the lignite from which the sample was taken.

Proximate Analysis

An average proximate analysis of a great number of samples of Saskatchewan lignites is as follows:—

Moisture	Ash	V.M.	F.C.	Fuel Ratio
26.13%	6.86%	28.11%	38.16%	1.35

Moisture

About 1 gram of the sample of powdered lignite is weighed out in a tared capsule with a tight fitting lid. The capsule of coal with the lid off is then heated for an hour in a toluol oven (toluol boils at 110 degrees centigrade, and a jacket surrounding the oven is kept filled with toluol vapour, thus giving a constant temperature). After cooling in vacuo in a desiccator, the sample is weighed again, and the percentage loss of weight is calculated. This gives the moisture content of the raw coal.

Ash

A one-gram sample of the raw lignite in a porcelain crucible is incinerated in a "Hevi Duty" electric furnace for four to five hours at a temperature of 2,000 degrees fahrenheit. The residue is cooled and weighed, and the percentage of ash calculated.

Volatile Hydro-carbons

As this is merely an empirical determination, results depend largely on manipulation, and on the type of apparatus used. The 1899 method of the American Chemical Society is as follows:—Place one gram of fresh, undried powdered coal in a platinum crucible weighing 20 or 30 grams, and having a tightly fitting cover. Heat over the full flame of a bunsen burner for seven minutes. The crucible should be supported on a platinum triangle with the bottom 6 or 8 centimetres above the top of the burner. The flame should be fully 20 centimetres high when burning free, and the determination should be made in a place free from draughts. The upper surface should remain covered with carbon. To find volatile combustible matter, substract the per cent of moisture from the loss found here.

Calorific Value

This is determined by the use of the Emerson Fuel Calorimeter. This consists of a strong steel receptacle called a bomb in which the combustible is placed and completely burned in an atmosphere of oxygen. The oxygen is under high pressure thus ensuring complete combustion. The fuel is ignited by means of a fuse wire dipping into the sample, the wire being brought to incandescence by the passage of an electric current.

During combustion the bomb is entirely immersed in a known amount of water, the rise in temperature of the water is accurately measured.

Then —

Heat units given off = rise in temp. x (Weight of water + C)

Where C = calorimeter equivalent.

The heat units can then be converted to B.T.U's. per lb.

The sulphur content of the coal can be determined from the results of this experiment.

The following table gives the results of some actual analyses made by the writer, and shows the form of record kept of each fresh car load of lignite coal as it arrives at the plant.

Chemical Control

Samples of coal are taken at regular time intervals from several different points in the plant. These are representative of the various stages of the process. As a result of the analyses of these samples the Chemical Engineer in charge is enabled to regulate the operation of the whole plant, as for example:

Feed to dryers,
Temperature of dryers,
Feed to carbonizers,
Temperature of carbonizers,
Rate of discharge from carbonizers,

and the many other details which are necessary to the successful and efficient running of the plant.

Conclusion

In conclusion, the economic importance of the work of the Lignite Utilization Board cannot be too strongly emphasized.

So far as the coal situation is concerned, Canada is divided into three zones:—

(1) The Maritime Provinces with their bituminous deposits.

(2) The Western zone, from the semi-bituminous coal fields of Alberta to the bituminous and anthracite deposits of Vancouver Island.

(3) The central zone — comprising the Prairie Provinces — which is devoid of all coal except low grade lignite.

If now the Bienfait plant can prove that it is economically feasible to briquette these low grade coals of which such vast deposits occur, the fuel problem of the Canadian Middle West will be solved. Moreover, the whole Dominion will reap enormous benefit by virtue of the fact that she will become independent of the United States from which source she at present draws 50% of her coal supplies.

The commercial experiment at Bienfait is being watched with intense interest by scientists and capitalists all over the North American continent and in Europe.

The plant is now about to commence operation, and it is hoped that the next six months will prove this process to be commercially practicable, thus demonstrating the wisdom and foresight of the Canadian Government in solving that all important problem — the efficient utilization of the vast fuel resources of the Dominion.

COAL ANALYSES						VALUES					
Sample	Car No.	Shipper	Net Wt. (Lbs.)	Kind of Coal	Date Rec'd.	H_2O	Ash	V.M.	F.C.	B.T.U. Lb.	Fuel Ratio
1	L.U.B. 1	Hassard	84,000	Slack	Aug. 5, 1921	30.3	12.0	26.8	30.9		1.15
5	C.N. 125,471	W. D. Co.	80,000	"	" 10, "	30.9	11.5	26.0	31.6		1.21
6	L.U.B. 1	Bienfait	84,400	"	" 22, "	28.8	14.4	25.3	31.5		1.24
11	L.U.B. 2	Crescent	82,200	"	Sept. 1, "	27.5	15.5	24.8	32.2		1.30
13	C.N. 125,471	M. and S.	80,500	"	" 1, "	28.2	12.8	25.7	33.3		1.29

Actuarial Factors in the Design of Irrigation Structures.

Economics and storage works; value of storage, available storage, capacity in relation to dam height and cost, storage capacity

H. B. Muckleston, M.E.I.C.

Paper Read before Lethbridge Branch, The Engineering Institute of Canada, January 14th, 1922

"The Civil Engineer has to deal with the "unpredictable, with those forces of nature that " 'are subject to no calculation'; and still he must "predict, still calculate them at his peril..he "must not only consider that which is, but that which "may be" *Stevenson.*

In presenting this paper the author wishes to say in advance, with the object of forestalling possible criticism, that it contains little or nothing original, or that has not been said before by others better qualified to say it. Rather is it a compilation of a few well known principles which are often overlooked, or not sufficiently emphasized. Engineering literature contains countless descriptions of works built, and these descriptions often deal exhaustively with the stresses and strains and peculiarities of design. But the economic factors are seldom mentioned and hardly ever even fairly well covered.

Engineering has been defined by an authority as "The art of making a dollar earn the most interest". Another authority defines it as "The art of doing well for one dollar what any fool can do for two dollars after a fashion" While we may not agree that either definition is the whole truth, we must admit that both contain a part of the truth and nothing but the truth. In this respect irrigation works are not in any way different from other engineering operations and must necessarily follow the same economic laws. Unless they do follow them, no matter what high degree of technical skill is shown in the details or in the general plan, they are not examples of good engineering.

Before we can conscientiously consider any design the best possible design, we must satisfy ourselves that economic principles have been followed and their requirements fulfilled.

Interest on a dollar can be earned, (or saved) in two ways. The first and most obvious way is not to spend the dollar. The second less obvious way is to spend two more dollars of capital in order to save the interest on four dollars which would otherwise be spent in maintenance and operation charges.

If engineers were omniscient they could always follow exact economic principles and know they were right; but lacking that faculty they must do the next best thing. Certain basic facts are always lacking in the data of engineering studies, and in default of the facts reliance has to be placed on the probabilities based on the best information obtainable. For instance:—In the design of a bridge one of the fundamentals is the possible wind load. We have no means of knowing what wind velocity may at some future time occur at any particular site, but we usually know with more or less certainty what velocities have occurred in the past and at what intervals, and with these facts as a basis the probability of a wind of any set velocity can be calculated or at least closely estimated.

The more complete our records, the better we are likely to prove as prophets. With the probabilities calculated it is an actuarial matter to determine the justifiable present expenditure to avoid a given probable expenditure at any set time in the future.

Economic Problems

The economic problem in the design of storage works is usually studied under the following heads:—

A. Determining the economic value of storage.

B. Determining the available storage from the run-off records over a series of years.

C. Determining the capacity curve for a wide range of dam heights.

D. Determining the unit-cost curve for a wide range of capacities.

E. Determining the economic storage capacity to be developed.

The economic value of storage is a complex function of a number of somewhat erratic variables. In general the steps in the problem are, first to find what water is worth delivered at the farm. Second the cost of delivery. Third the residual, which is roughly the value of the storage. This looks simple enough; but the apparent simplicity vanishes when the different steps are tackled. It will, however, be assumed that this part of the problem has been solved, and also that the available storage has been calculated from the records, and that a table of capacities for various depths has been prepared. This brings us up to the calculation of the unit cost curve, and here the engineer's economic problem begins in earnest. The cost at any capacity is a sum of the capital cost of the works and the capitalized cost of the maintenance and operation, plus, in some cases, a further item for the renewal of the works at some future time, amortized insurance charges and some other special charges which are applicable in certain cases but not in all.

It will be assumed for purposes of illustration that the cost of storage is represented entirely by the cost of the dam and its appurtenances. If there be other works to be considered the same principle will apply. It will be necessary first to decide on the material and type of construction to be employed in the dam.

If there is any very wide variety of choice possible with the local conditions as they exist, there is a secondary economic problem involved in the choice; but if local conditions dictate the material and style of construction as they often do, the problem is simpler.

Dams have been built of earth, loose rock, masonry, either as gravity or arch dams, wood, steel and reinforced concrete; and each material introduces some secondary economic problems peculiar to itself.

If the dam is to be of earth or loose rock, a separate spillway is a necessity and a certain freeboard must be provided. The economic problem is, how much? Freeboard and spillway capacity are safety measures and both cost money. How much money is it justifiable to spend in anticipation of something happening at an indeterminate date in the future?

Spillway Provision for Floods

Spillway capacity is provided to guard against floods and freeboard is provided as bulwark against wave action and to enable the spillway capacity to be utilized. If too much of either is provided it may never be used and our dollar is not earning the most interest, if too little is provided the whole works may be destroyed and our dollar may cease to earn any interest at all.

Evidently the possible flood to be provided against is the important question in this stage of the problem. It must be considered that, given time enough, any size of flood may occur on any kind of stream. The various possible causes of high water in these lattitudes are (a) a heavy winter snowfall in the mountains, (b) a late quick Spring, (c) heavy rain on the watershed, (d) precipitation on previously saturated catchment areas, (e) precipitation in which the storm center moves down stream, (f) breaking of logs and ice jams, beaver dams, etc., (g) destruction of other storage works higher up in the valley. Any combinations of these causes may occur. Any one of these acting alone may cause high water, and possibly could, though not necessarily would, cause what might be called unusually high water, or perhaps moderate floods. Three would probably cause moderate floods, and might cause unusual floods, while all together might cause floods which could be called disastrous. The records, such as they may be, give an indication of how frequently each one of the causes, (except the two latter) is operative on the average, and by combining these frequencies we can arrive at the probability of any conjunction of two or more. For example let there be five possible events and let their frequencies, as established by a long series of observations be as follows:—

No. 1	Once in	2 years	frequency	equals	½
2	"	6 "	"	"	1/6
3	"	10 "	"	"	1/10
4	"	12 "	"	"	1/12
5	Twice in every year		"	"	2

Then the probabilities of No. 1 and No. 2 coming in the same year is 1/12; of Nos. 1, 2 and 3, —1/120, and of all five happening in the same year, 1/720. Further, suppose examination of the records shews that No. 1 happened in May on nine out of ten occasions. The probability of its occurring in May of any selected year is evidently ½ x 9/10 = 9/20. Similarly, the probability of No. 2 occurring in May of any year might be 7/60 and that of Nos. 1 and 2 occurring together in May of any year would be 63/1200.

This is the ideal method of attack in such problems, but it is seldom that it can be used, as our information in the shape of records seldom takes just this form. What the records do shew is the relative frequency of floods and high water of varying degrees of magnitude. Each high water or flood may be considered as the result of one or more causes, acting with greater or less intensity; and the frequency of the various maxima of discharge may therefore be considered as a measure of the frequency of coincidence of the various acting causes or degrees of intensity. If therefore the record of previous years is extensive enough it should be possible to calculate the probability of a flood of any given magnitude occurring in any set period. This calculation may be made by fol-

lowing the mathematical theory of probability which is a somewhat laborious business or it may be accomplished with sufficient accuracy by plotting the recorded observations on probability paper, as described by Allen Hazen, M.E.I.C. As an example:—The Ohio River at Cincinnatti has been under observation for 60 years and the records of the gauge heights so plotted shew that for 99% of those years they have exceeded 33 feet, for 90% they have been in excess of 41, for 40% they have exceeded 53, for 5% they are more than 64, and for 1% more than 69. An extension of the curve shews that a flood in excess of gauge 75 might reasonably be expected only once in 1000 years. This does not mean that such a flood will not occur next year or the year after. It is merely an indication of the reasonable betting odds on the chances which, in the long run we can afford to take.

Failing any other means of fixing the maximum flood to be provided against, recourse must be had to some of the many formulae for this purpose; but it must be emphasized that these formulae have a very limited range of usefulness and can only be applied with a very large mixture of judgment. There is one formula which is said to give good results and as it is frequently used it may be given here without apology:—"Convene an extraordinary session of the Ancient and Honourable Order of Highwater-liars and take a vote, then provide for twice as much".

Economics of Flood Preventiod

After the probabilities of any given flood discharge are determined, it is necessary to determine how much it is justifiable to spend in capital in order to avoid paying damages which such a flood might cause in the future. For instance, let it be assumed that the calculations shew that a flood of 60,000 sec. ft. might be reasonably expected on the average once in 100 years or that its probability is 1/100, 50,000 once in 20 years, probability 1/20, 30,000 probability 1/3 and so on. If this is the true law of probability, then a flood of 70,000 might be anticipated as occurring only once in 500 years and one of 80,000 only once in 5000 years. If money is worth 6% how much is it justifiable to spend on provision against floods, which otherwise might wipe out the investment? If the event may occur once in ten years, with money costing 6%, we are justified in spending about 56 cents for every dollar of investment. If it may occur once in thirty years the justifiable expenditure is about 17 cents, and if the period is 100 years it is only 3/10 of a cent. This is not quite the whole story because the failure of the dam might have consequences far beyond the mere loss of the first investment, and what must be considered is not the investment wiped out but the total of the possible damages.

Having decided on the magnitude of the probable flood to be provided for, it is next necessary to determine its duration, and the necessary flood freeboard, as measured from the storage capacity above normal H.W.M. Assume for example that the stream we are dealing with may be reasonably expected to discharge 20,000 sec. ft. and that such a flood might be reasonably expected to exceed 10,000 for a period of 48 hours. From the hydrograph of such a flood we find that the discharge during that period might amount to 60,000 acre ft. How high will the reservoir rise, assuming it was full to H.W.M. when the flood started?

By calculation it is found that the storage capacities above H.W.M. are:—

1st foot	8,000 acre feet
1st-2nd "	18,000 " "
1st-3 "	30,000 " "
1st-4 "	44,000 " "

It will be further assumed that the spillway is a simple overfall weir and that its discharge for any given head is a direct function of its length. The next step is to construct by a—trial and error—process a hydrograph for discharge of the spillway on the basis of an assumption as to length. This hydrograph together with that of the stream and the curve of storage capacities will shew how much of the flood water passes directly through the reservoir and how much goes into temporary storage, or in other words, how high the level of the reservoir will rise. It is evident that this height is some function of the length of the spillway crest and by making several such calculations a curve of flood heights can be plotted against spillway lengths, or spillway costs.

Freeboard and Wave Height

At this point it is necessary to consider the question of freeboard as affected by wave heights. It will be assumed that the general design of the dam has been settled and that we have selected an earth fill dam as the best type for the situation. The upstream slope will be assumed as 3-1. The possible wave height is a somewhat complex function of the fetch, or the longest stretch of open water over which the wind may act in a straight line. It does not appear to be affected much by the velocity of the wind, which only alters the length and velocity of the valve.

With a fetch of six miles and in deep water we might expect a wave height of between four and five feet, and if a wind velocity of 110 miles per hour is a reasonable expectation, such a wave might have a length of 70-90 feet and a velocity of 19-22 feet per second, and the pressure developed by impact of such a wave might be as high as 2500 lbs. per sq. ft. These figures are for open water; as the water shoals the waves become shorter and higher and the velocity somewhat less. For such a case as the dam under consideration a wave height of six feet is not impossible and our freeboard should be something greater than this or else a parapet of proper design should be provided. This free board must be added to the flood heights as determined above.

We are now in a position to calculate and plot a curve of costs based on various top elevations. Since these elevations have been shewn to depend on the length of the spillway crest, this curve will shew us which spillway length is the most economical in capital cost for a given capacity.

The cost of maintenance will not be a constant but will vary somewhat with the height, length of spillway, area of surface protected by rip-rap or other means, and with other factors of more or less special application.

The above analysis is based on the cost of the dam and spillway only. There may be other considerations such as relocation of railways and highways, land damages, and the effect on other developments above or below etc. Again, the cost of maintenance, which is a relatively

small matter for an earth dam or a masonry structure, may be relatively great in the case of a framed structure of steel, timber or reinforced concrete.

Storage Capacity

In some cases the real economic problem is the amount of storage capacity to be provided. So long as the run-off of the stream is in excess of any possible economic storage, the quantity to be developed is more or less closely determined by the value of the stored water. But in the reverse case where the whole run-off, even in the biggest years, could be stored at less than that value, it may not be economical to develop storage for the maximum possible quantity because that quantity occurs so seldom For instance, on a certain stream it is found from the records that the mean or average annual run-off over a long series of years is 100,000 acre feet. The maximum annual run-off during that time has been 200,000 acre feet which occurred in only one year out of the 50 for which records are available. It would hardly pay to develop storage to that capacity even if it were feasible. On the other hand a capacity of only 100,000 acre feet might be economically too small.

If the mean annual run-off be calculated for a long series of observations and the excesses or deficiencies be tabulated in order of magnitude it will generally be found that these differences, regardless of sign, vary in frequencies inversely as their magnitude. If the observations extended over a long enough period it would probably be found that these differences followed the mathematical law of error. Usually the series is not long enough on any one stream to demonstrate this, but by combining the records of several streams it may be shown that the law holds approximately, and the probability of a run-off of any magnitude may be calculated. The question then resolves itself into calculating how much it is justifiable to expend in providing storage capacity which may be filled only in a relatively small proportion of the years. Incidental to this question is the use of the stored water. Irrigation is provided for two reasons, and one or both may be operative. The first reason is that no crops can be grown in any year, or in a certain proportion of years without it, i.e. irrigation is an absolute necessity for part of the time. The second reason is that more valuable crops can be grown any year with than without it. The first is preventive irrigation, the second is productive. Manifestly, when a thing is a necessity we can go to greater lengths to secure it than when it is a luxury, or at least, we should feel justified in spending more money or taking a longer chance. It will not ordinarily pay to develop storage which can only be filled in one year out of twenty, it will seldom pay to anticipate the one year in forty, and it may be safely said that under no circumstances should we be justified in looking ahead much more than one year in sixty. Similarly in calculating the storage which may be reasonably counted on we might ordinarily neglect the low water years which occur only once in twenty, generally the one in forty, and almost certainly the one in sixty.

So far the discussion has proceeded on the tacit understanding that the life of the reservoir is practically infinite. In theory every reservoir constructed on a silt bearing stream is due for extinction sooner or later, by filling up with silt, unless special measures are taken to combat it. This may be so far in the future that economically its life may be considered infinite. But this is by no means always the case. There is one example in New Mexico, in which 61% of the whole capacity has been filled up in 12½ years. Another, in Spain, built in 1875, is now silted full and has been for many years. Evidently such storage must be exceedingly cheap or it cannot be an economical development. In some cases it is possible to prevent this silting up by spending enough money on prevention measures. At Assouan the problem was solved by building what is to all intents and purposes a moveable dam and allowing the heavily silted flood waters to pass practically unchecked, while storing only the lighter laden or relatively clear waters of the falling flood. In other cases dredging may be an economical solution. But whatever solution can be adopted it can only be had at a price and the storage may or may not be worth it.

Cross Drainage Works

Every irrigation canal, in the upper reaches at any rate, crosses the country drainage. This drainage must be taken care of either by taking it into the canal or by passing it across. It is not always either possible or wise to take it into the canal, and in any event, the discharge which may be expected in any drainage channel is a matter of some consequence. The unknown element in the discharge to be provided for. If we guess too low the smash-up comes early in the game. It can never be known if the capacity is just right, and a margin of safety is a comfortable thing to have in reserve. But if we guess too high there it is an unnecessary expenditure. There have been some startling illustrations of extraordinary discharges from insignificant streams, and yet the number of such cases compared with the number of drainage crossings is almost zero. Probably the most instructive example of such a discharge is the Kali Nadi flood of 1885 in the Lower Ganges Canal in India. The river in normal times is a small stream of insignificant proportions. It has a catchment area of 2377 sq. miles, but, ordinarily its bed and banks are cultivated. In 1884 a flood of 50,000 sec. ft. occurred and did some damage to the canal crossing, which had been designed for only one quarter that amount. While the old crossing was being repaired designs were made for a new structure to pass 60,000 which it was expected would be sufficient. In 1885, before the new structure was commenced, a flood of 133,000 sec. ft. occurred and completely obliterated the aqueduct and every bridge but one on the stream for 150 miles. Even the natives, who are taught by tradition to keep their villages well above danger, were no better off, as many villages were swept away. It might be noted here that the name of the stream should have been something of a warning—"Kali Nadi" means—"River of the Goddess of Destruction".

This particular case has value in shewing that local indications of flood discharges are not always reliable. Just below the crossing there was a road bridge, much more than 100 years old. Flood marks above and below this bridge were quite plain and from these and the dimensions of the bridge it was calculated that a flood of 8,500 sec. ft. was possible. The crossing was made a little larger than this, having a capacity of about 12,000. After the

big flood subsided it was found that this old highway bridge was the only structure intact in 150 miles of the river. It had merely been submerged and was hardly damaged at all.

In very few cases have these drainage channels been under observation for any great length of time, if at all. Their catchment area can usually be determined with fair accuracy and its character can be ascertained by inspection or survey. None of the formulae for flood discharge are much use, as they all contain a coefficient and most of them ignore the rainfall. The precipitation record of the catchment area, or, if not available, on a neighbouring one of the same character, is the best guide. If this record is long enough and detailed enough it is possible to calculate curves of probability for a wide range in duration and intensities. The direction of travel of cyclonic storms is almost a constant for any locality, and from the curve of probable intensities, a similar curve of probable run-off at the site can be derived. The question is complicated by climatic conditions, specially in this country where snowfall is a principal factor in the discharge of such channels. In any event we should try to establish by past history, a frequency curve for flood discharges of any selected magnitudes. Having done this it is possible to calculate the justifiable expenditure now, to avoid complete disaster at any future time. For simplicity let it be assumed that the cost of a certain cross drainage work is direct straight line function of its capacity and for further simplicity assume that each cubic foot per second will cost $100.00. It will also be assumed that our analysis of the probabilities has shewn that a flood of 100 sec. ft. may be exceeded in nine years out of ten, and that for other floods the frequencies are:—

200 sec. ft.	Frequency	.60
250 " "	"	.42
300 " "	"	.24
350 " "	"	.11
400 " "	"	.03
450 " "	"	.014
500 " "	"	.003

If money costs 6% what is the justifiable expenditure? The costs will be for:—

100 sec. ft.	$10,000.00
200 " "	20,000.00
250 " "	25,000.00
300 " "	30,000.00
350 " "	35,000.00
400 " "	40,000.00
500 " "	50,000.00

As long as the structure lasts we must pay interest and when it is destroyed we should have a sum of money ready to replace it. At 400 sec. ft. its expectation of life is thirty-three years, cost $40,000.00, the annual interest would be $2,400.00 and the annual charge to sinking fund would be $240.00, total $2,640.00. On a 350 sec. ft. basis the expectancy is nine years cost $35,000.00, interest $2,100.00, sinking fund $3,045.00 total $5,145.00. For 450 feet the total annual charge is practically $2,700 and for 500 sec. ft. about $3,000, so that in such a case it would pay to build for a flood of about 400 sec. ft. although such a flood might be expected to occur not oftener, on the average, than once in every 33 years.

The Value of Permanence

Absolute permanence is not a possibility, even the eternal hills decay. What is usually meant by permanence is a useful life so long that the annual charge to replacement account is practically zero. Even this kind of permanence is not always economical, for it may cost more than it is worth. There is for each individual case a useful life which in the long run is the most economical. The annual charge for maintenance and operation may be divided into two parts. One part is the cost due to progressive deterioration in the structural integrity of the work, the other is a more or less constant charge due to conditions of service or ordinary wear and tear. The first part is practically zero with a new structure but rapidly increases in an increasing ratio as the structure gets older. Sooner or later this charge is equal to the interest on the cost of a new structure and at that time other things being equal it would be economical to rebuild. There is also a depreciation charge which is the cost of the new structure spread over the useful life of the old.

For example let us assume that a certain work has been designed and it is estimated that for a structure of type "A" the cost would be $1,000.00 and the useful life fifteen years. For type "B" the figures are $1,200.00 and thirty years, and for type "C" $1,500.00 and 50 years. The cost of operation would not vary materially for the three types. It will be further assumed that the original money is raised by the sale of stock bearing 6% and that new money will cost the same rate.

The annual charges for these types would be about as follows:—

	Type "A"	Type "B"	Type "C"
Cost	$1,000.00	1,200.00	1,500.00
Life	15 years	30 years	50 years
Interest	$60.00	72.00	90.00
Depreciation	41.70	13.00	4.50
Amortization	43.00	15.60	4.50
Av. Maintenance	30.00	36.00	45.00
Av. Annual cost	$174.70	136.60	143.00

It has been assumed that amortization and depreciation investments will bring the same rate of interest as the original money, which is not by any means always the case. As they stand, however, the figures shew that even a relatively high degree of permanence may cost more than it is worth and that a moderate degree may be better than either too much or too little.

The Cost of Operation.

It is frequently possible by refinements in design to save a considerable annual amount in the costs of operation As an extreme case we might take a system where all the distribution is by means of closed channels. In such a case, provided the pipes could stand the pressure there would be very little cost properly chargeable to the delivery of water, as each user would open and close his own outlet at his own convenience. Such a happy state is of course seldom a practicable one; but we can conceive of various intermediate conditions which might be practicable, if they could be got economically. The question thus arises of how much is justifiable to spend in capital to save operating costs.

If we assume that the capital is raised on thirty year bonds at six per cent selling at par, the annual cost to the owners of the system for the money alone will be the interest plus the sinking fund which will work out at 7.3%. It is not probable that the bonds would sell at par but at a discount, and we will assume for ease in calculating that the actual cost of the money is 8%. If a certain annual expenditure in operation and maintenance can be saved by spending a little more capital, or, which comes to the same thing, an equal annual revenue can be obtained, are we justified in spending it? Our additional capital expenditure must earn (or save) sufficient money annually to do two things, pay the interest and the sinking fund. On the assumed conditions we might spend $11.26 for every dollar we expected to earn or save, and at the end of the period be clear of debt. If the period were in perpetuity we could spend $12.50 while it it were ten years the amount would be $6.71, similarly at 3% the amounts are $19.60, $33.33 and $8.53.

This paper is intended to shew that good design involves considerations additional to those of stresses and hydraulic coefficients that the best design is not of necessity the cheapest in first cost or operation, and that the designs are as much dependent on the financial foundation as the structural.

Maryland Street Bridge, Winnipeg

Discussion of design as affected by local conditions and aesthetic considerations. Description of two-arch concrete bridge, with details of concrete tests, etc.

J. F. Greene, M.E.I.C.

Paper read before Winnipeg Branch, The Engineering Institute of Canada, January 5th, 1922

The Maryland Street bridge is a reinforced concrete arch structure provided to carry traffic across the Assiniboine river between the business section and the best residential section of the City of Winnipeg. The deck consists of a roadway 50 feet wide and two side-walks each 7 feet wide, provides for four lines of vehicular traffic including street cars, with a maximum grade of 2%.

While the structure, as a type of the standard barrel arch class of concrete bridge is not an object of special interest, the proportioning of the parts of this particular bridge to form a harmonious whole, and the mental processes involved in the proportioning may be of interest to men engaged in the solution of similar problems.

The determination of the number of spans was not left to the designers. While comparative estimates disclosed the fact that a three span bridge was slightly cheaper than a two span structure and while aesthetic precedent would demand three spans rather than two, the Department of Public Works objected to the location of the South pier in the navigation channel and intimated that only a two span bridge would be acceptable.

The elevation of the crown of the South span was fixed as a result of the clearance set by the government for navigation purposes; hence the curves for the arches had been approximately pre-determined; enough to enable one to make preliminary sketches to ascertain how to treat most effectively, the abutments, piers, spandrel walls and approaches.

Architectural Limitations of Concrete

A slight digression upon the architectural limitations of concrete as applied to bridges, may not be amiss. A concrete bridge presents all exposed faces of one colour, a dull monotonous grey. These faces in turn, disclose various irregularities, due to the method of constructing concrete structures; each lift, or day's run of concrete is distinctly outlined in any exposed concrete surface; board marks have distinctive entities of different shades of grey, some dark, some light, due probably to the absorptive capacities of the several boards, any yielding of forms, no matter how slight, results in offsets or waves; occasionally rock pockets appear which must be covered by disappointing patches. All such appearances are irregularities, and are displeasing to the eye. It is incumbent upon the designer so to proportion the major members of the structure as to make it pleasing and dignified, while at the same time so to accentuate the minor members by the use of pilasters, inserts and grooves as to withdraw the attention from the essential defects of concrete surfaces.

Fig. 1 Photograph taken June 11th 1921, falsework and forming for arch for East half of bridge, showing method for forming arch. Note old steel bridge in position just to West.

Design as affected by Appearance

Returning now to the point at which we digressed. It has been assumed as axiomatic that the dimensions and proportions of the several parts should be indicative

of the service which each part contributes to the stability of the whole. The abutments, marking clearly the river banks and the limits of the arch spans, should appear to the observer as of sufficient mass to successfull withstand the horizontal thrust from the adjacent arch spans. The pier, while of sufficient mass to carry the vertical loads transmitted from the arches, should present faces so proportioned as to offer the least obstruction to the passage of ice and water.

With these limitations and axioms in mind, preliminary sketches were made. In one sketch an excessive use of horizontal lines, and in another an equally excessive use of vertical lines, disclosed the basis of the proper treatment for this structure. The structure outlined appeared to be squatty, this quality being exaggerated by the excessive use of horizontal lines and relieved greatly by the appearance of vertical lines. Proceeding from the assumption that the structure lacked depth, abutments and piers were increased in height to a level above that of the handrails; the surfaces were broken with deep vertical grooves, and even the form boards were placed vertically to further the illusion of depth. The spandrel wall surfaces were broken up by pilasters which in turn were exaggerated by inserts at both edges to accentuate vertical shadow lines, contributing thereby to the depth illusion.

To conceal the results of yielding forms and the outline of each day's run, grooves were left in the concrete at regular intervals, both in the arches and in the walls; with each day's run ending in a groove, the line of the joint was concealed; and in addition the grooves themselves gave shadow lines which tended to relieve the monotony of the large flat grey surfaces.

In proportioning the exposed portions of the sidewalk slabs and brackets it was expedient to exceed the structural requirements of the design, lest the parts should appear too light for stability. By breaking the sloping side faces of brackets into several vertical faces, an illusion of breadth and strength was produced and the impression which would have resulted from the monotonous succession of plain brackets altered to a definite and pleasing one.

This completes the consideration of the proportioning of these parts of the structure, which should appear to observers standing either upstream or downstream from the bridge. The treatment of the deck of the bridge presented a separate and a different problem. Smooth, easy approaches from connecting streets with the least possible grades attainable were desiderata. The elimination, or failing this, the subordination of all trolley and light poles on the deck of the bridge, was adopted as a policy which should be pressed consistently.

The design of the handrail, the outstanding portion of the structure visible from the deck, remains. Since the observer views the handrail, not from a distance, as he views the arches, piers, and abutments, but at close range, the appeal to the imagination lies not so much in the tout ensemble, the grouping of the parts into a well balanced whole, as in the excellence of the parts themselves the intricacy of the fabric and the quality of the texture. Hence it is essential that special methods of handling the concrete should be adopted so that the surface irregularities of commercial concrete, such as air holes, water holes, and form marks, shall be eliminated. This may be accomplished in various ways, either by the dry process, or with sand moulds, or by scrubbing the surface of green concrete with steel brushes to expose a specially prepared coloured aggregate. On the Maryland Bridge the third method was adopted; the coloured aggregate consisting of red granite, crushed to pass a ¾ inch screen, was exposed by scrubbing with steel brushes and cleaned by several washings of muriatic acid and water.

The illumination has been provided through the medium of four-light clusters, set on combination light and trolley poles, standing in the devil strip and located about 90 feet apart. Each light is diffused by wide angle Holophane refractors which reduce materially the glare; and the lights have been set high enough on the poles to eliminate dangerous shadows from passing cars.

This is a brief and somewhat obvious resumé of the principles and methods involved in the asthetic phase of the design of the Maryland Bridge.

Structural Features

A consideration of the structural features may now be in order. The adoption of a solid barrel, earth filled arch, rather than an open spandrel reinforced concrete deck bridge, rested primarily upon economic grounds and secondarily upon structural considerations. With an average fill of ten feet, the earth fill arch showed a saving of 25% under an open spandrel arch; on the approaches the saving was greater, since the increase in the cost of the deck was not offset by a reduction in the substructure cost due to reduced dead loads. Further, the earth fill type, exposed only at the intrados, is less subject to movement and cracking due to extreme temperature changes than the open spandrel. In addition the solid barrel type offered greater mass and at the same time less obstruction to the passage of ice.

In the design of the approach retaining walls, a radical departure from standard practice was made in that the foundations for these walls were carried down through more than 20 feet of excavation, and bonded into the rock.

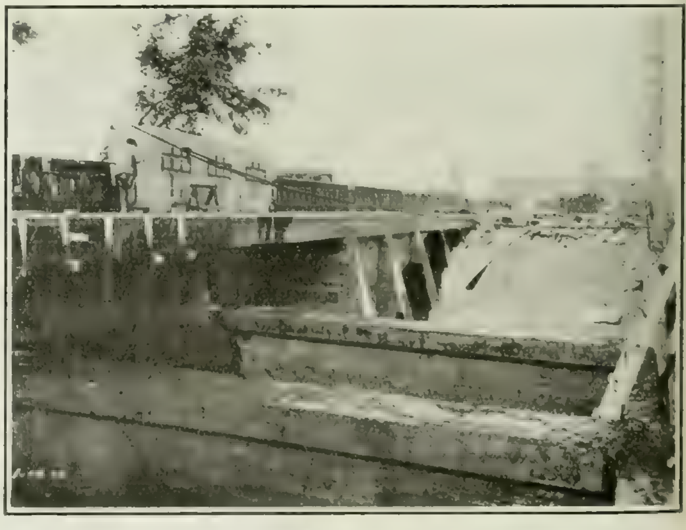

Fig. 2 Construction of West half of bridge before fill placed, sidewalk spandrel walls and counterforts on left, tiewalls between approach walls at bottom.

This exceptional treatment was due to exceptional conditions at the site. Just East of the North end of the bridge, the Cornish Baths had given evidences of a strong tendency to move toward the river, and a few hundred feet West of the bridge, several apartment blocks had actually moved and tilted; one section of one of these blocks had been condemned and demolished. The evidence was clear that the bank was not stable and that structures resting on this bank would be equally unstable; hence the reason for the unusual foundations for these approach walls.

Each arch was designed for a maximum live load of four 50 ton cars with an additional impact allowance of 20%. The arches have been so proportioned that under all conditions of loading the line of resistance lies within the middle third, resulting in a maximum compression of 453 pounds per square inch. The maximum for combined live load, dead load, rib shortening, and a temperature drop of 40 degrees is 682 pounds per square inch; and for a temperature drop of 60 degrees, the maximum combined stress is 750 pounds per square inch. For tensile stresses due to rib shortening and temperature, steel reinforcement has been provided.

The structure rests upon solid rock foundations. The abutments were designed with the line of resistance within the middle third and with a maximum pressure upon the rock of 9¼ tons per square foot. The rock was excavated to a depth of 6 feet to provide additional resistance to sliding. The maximum bearing pressure from the pier upon the rock is 11 tons.

The spandrel walls were designed as cantilevers resting upon the arches, the moment from the side-walk brackets being transmitted through counterforts to the arch ribs. Expansion joints at the haunches provide for lateral movement resulting from the fall of the arches due to a drop in temperature, and at the third points expansion joints predetermine the cracks resulting from the rise of the arches due to a rise in temperature. All joints have been projected to the handrails and appear to be working satisfactorily; those at the junctions of the handrails with the piers and abutments have opened approximately ¾″ at this writing. All joints in the walls and side-walks have been sealed by folded strips of sheet lead to prevent the escape of water through the joints with the attendant discoloration of the concrete.

Concrete Proportioning

The proportioning of the concrete itself remains for consideration. The engineering department had been instructed to use the gravel and rock provided by the Greater Winnipeg Water District at a price of $3.85 per yard for gravel supplied during the winter, $3.00 per yard for gravel furnished during the summer, and $4.00 per yard for crushed rock. The problem, stated simply, was to determine the economical proportions of cement, sand, rock and water, combined to form concrete which would give an assured conpressive stress of 2250 pounds at 28 days, i.e. three times the maximum stress in the arches. Preliminary investigations disclosed the fact that there were wide variations in the physical characteristics of different samples of gravel from the same pit. Tests of the gravel showed that the weights per cubic foot varied from 98 to 115 pounds, and the percentage of coarse retained on a ¼″ screen varied from 21% to 45%. Two series of tests

Fig. 3 Method of construction of West half of bridge, East half already opened for traffic. Method of forming sidewalk slab and concrete plant for pouring same clearly shown.

were carried out, each embracing the making, and breaking in the testing machine of 60 cylinders 6″ in diameter and 12″ long. In the first series, a lighter coarser gravel, weighing approximately 100 pounds per cubic foot was used: the materials were combined in one group to make one part of cement to six parts of the aggregate such as 1 - 1½ - 4½, 1- 2 - 4, 1 -3 - 3, 1 - 3½ - 2½ and 1 - 4 - 2: and in another group to make 1 to 7½ such as 1 - 2 - 5½, 1 - 2½ - 5, 1 - 3 - 4½, 1 - 3½ - 4.

In the second series while similar proportions were used, the gravel itself was more dense, weighing approximately 114 pounds per cubic foot. While no mechanical slump test for consistency was employed, the amount of water used was the smallest consistent with proper workability. The percentages of water for the first series varied from 6 to 8 by weight of the cement and aggregate and the water cement ratio from 0.58 to 0.86 by volume; for the second series the percentage of water varied from 7% to 9%, and the water cement ratio from .76 to 1.05.

Concrete Tests

Compression tests at 28 days showed that cylinders of the first series were approximately 22% stronger than cylinders of the second series composed of the same proportions by volume. Since prudence would dictate that we should base our decision upon the tests of the weaker of the two series, we concluded that the most economical combination from which we might expect to get concrete of the desired compressive strength was 1 part of cement to 3 of gravel to 2½ of crushed rock; while the best results for the foundation concrete containing five sacks of cement to the yard were obtained with a combination of 1 of cement to 4 of gravel to 2 of rock. Complete records of the properties of the ingredients and of the concrete, were prepared and filed for reference.

In order to obtain assurance that the concrete in the structure was of the quality anticipated as a result of the tests, sample cylinders made of the concrete actually placed, were taken daily and tested at 28 days. The concrete placed in the substructure, containing 5 sacks of cement per yard, was very dry, of a consistency such that it would just quake under tramping. The average of the tests run during the months of February, March and April for this class of concrete was 2100 pounds per square inch at 28 days. The concrete in the approach walls, containing six sacks of cement per yard, was wetter than the foundation concrete, but with only enough water to permit of spading and consolidating the mass in the thin walls. The average of the tests for this class of concrete placed during May and June was 2300 pounds per square inch. The concrete in the arches containing six sacks of cement per yard was of a consistency such that it would not flow, while at the same time containing sufficient water so that it would quake upon being worked up. The average of the tests for the concrete in the arches at 28 days was approximately 2800 pounds per square inch. The importance of keeping the water content of the concrete at a minimum consistent with workability was emphasized and impressed upon the construction organization, with the result that we were able to obtain a result which more than equalled our anticipations. The increase in strength from 2300 to 2800 pounds per square inch for concrete with the same combinations of solids but of different consistencies, is significant.

The proportioning of the handrail was the result of cut and trial methods, sample slabs having been prepared of different combinations of the aggregates; these samples, after having been scrubbed and washed, were placed side by side and compared. The proportion adopted was 1 cement - 2½ broken red granite - 1 granite dust - 1½ torpedo sand.

The construction methods adopted for this work involved no spectacular operations. The prescribed task was the construction of the new bridge with a minimum of interference with the dense traffic over the steel bridge, the centre line of which was West of the new bridge, with the floors of the old and new bridges overlapping.

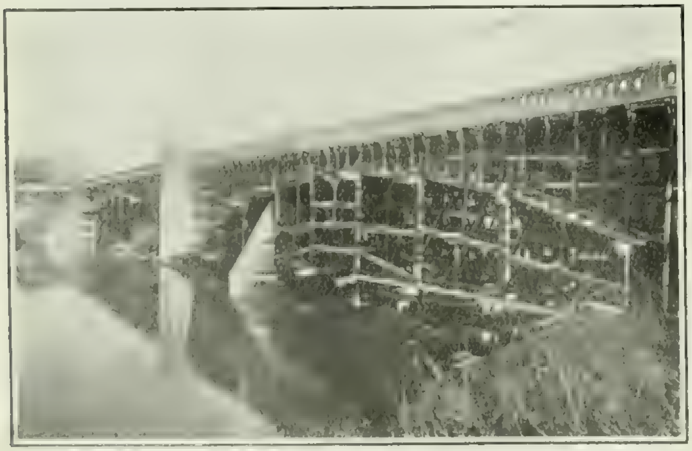

Fig. 4 West half of bridge nearing completion. Falsework and supports under sidewalk forms still in place. Handrail placed, and workmen engaged cleaning and scrubbing same.

The substructure of the abutments and pier were constructed as units; the superstructure, including arches, walls, side-walks, and fill, was constructed in two parts, the East half of the bridge having been completed and thrown open for traffic before the wrecking of the steel bridge, and the commencement of construction upon the West half. This plan was adopted on the ground of economy, and because operations might be conducted under this method with the least interference with traffic.

Progress of Work

The excavation of the abutments begun in December, was carried out with the usual derrick and skip or bucket equipment and was expensive owing to the seasonal cold. In preparing the foundations for the pier, an orange peel was used to remove a surface layer of rocks and boulders; a line of Wakefield sheet piling was driven from leads suspended from a derrick boom; this piling was backed by a puddle, the combination affording an adequate water-seal whereby the water was kept down within the dam with a single centrifugal pump. In excavations for the abutments and approach walls, sufficient water was encountered to necessitate the continuous operation of pumps.

The concrete plant for the foundations included a paving mixer with a side loading hopper for which extension leads had been prepared. In concreting the pier, this mixer was placed on cribbing at an elevation high enough to permit of dumping direct from the mixer to the pier; the cement, gravel and rock, placed in the loading hopper with wheel barrows at ground level, were elevated to the mixer over the extension leads. In concreting the abutments, the mixer was placed on the ground near the edge of the excavation, the aggregate placed in the side loader with wheel barrows, and the concrete conveyed through chutes to place.

The water and aggregate for concrete placed during the cold weather were heated: the spaces containing concrete were housed and heated for a considerable period after the placing of the concrete; every effort was made to give the concrete the advantage of being cured under conditions approaching normal.

The concrete plant for the superstructure consisted of a bin into which sand and rock were loaded from a bucket elevator, drawing from pits into which gravel and rock had been dumped, from heavy automobile trucks. This plant was so located in the West half of the North approach that it was possible to complete all concrete work without interference from the plant.

The concrete dumped from the mixer into side dump cars was drawn to place over a light wooden trestle by a small gasoline dinky, the engine for which had been taken from the mixer. In placing the concrete for the side-walk and spandrel walls, concrete buggies were drawn to place by the dinky on flat cars made in part of the trucks from the side dump cars. The plant was cheap, eminently satisfactory, and the results were excellent.

The falsework was conventional, except perhaps, in the method employed to obtain the arch curve. In place of the standard practice of cutting the curves from the stringers, wedges and waste blocks and planks were added

to build up the curves on plain stringers. Under this method much lumber otherwise worthless was used, and the stringers of new stock were available after use in a condition as good as that of new lumber.

Cinders for the fill were accumulated in an adjacent vacant lot during the first half of the year. These cinders were loaded into dump carts with a light electric Thew shovel and hauled to place on the bridge.

Construction began in December 1920; the East half of the bridge was thrown open for traffic in August; the West half in November; and the street car traffic commenced on December 1st 1921.

The contract for the construction was awarded to the city engineer, W. P. Brereton, M.E.I.C., on a competitive basis, at a price of $250,000.00, and the bridge has been completed well within the contract price. The project was carried out with A. L. Cavanagh, A.M.E.I.C., as superintendent; Allan Cotman, chief draftsman, and J. F. Greene, M.E.I.C., as consulting engineer.

Fig. 5 Complete bridge with light poles erected and street cars operating over bridge.

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VOL. V. April 1922 No. 4

Professional Meetings 1922

Vancouver: June sixteenth and seventeenth.
Winnipeg: September fifth, sixth and seventh.

British Columbia Professional Meeting.

It has been the desire of members of *The Institute* resident in British Columbia for several years, to hold a professional meeting in their Province. Last year there was a tacit understanding, at the Professional Meeting in Saskatoon, that during the coming summer, support would be given by the Prairie Provinces to such a meeting in Vancouver or Victoria. While the General Professional Meeting in Winnipeg would make two meetings west of the Lakes within a few months, it is still felt that a meeting at the Coast would not interfere with the Winnipeg meeting, and be sufficiently supported to insure a representative gathering.

The approval of the Council of *The Institute* was given, at the March meeting, to a professional meeting of *The Institute* in Vancouver, to be held on June sixteenth and seventeenth. The proposal to hold the meeting in Vancouver was endorsed by the Victoria, Saskatchewan, Calgary, Edmonton, Lethbridge and Winnipeg Branches. In June Vancouver is seen at its best. The progressiveness of the B.C. members is well known, and it goes without question that the meeting approved will be a complete success.

Code of Ethics

Engineering ethics came up for discussion at the last meeting of Council, the question being raised by a councillor as to whether the present Code of Ethics affected non-corporate members. Although the question of changing or enlarging the Code of Ethics of *The Institute* is now before the Committee on Policy, it was decided by Council to delete the word "Corporate" from the present Code of Ethics, as appearing on page twenty-three of the Charter, By-laws, List of Members, the word "Member" following, in each case to appear without a capital, the interpretation being that the Code should apply to all grades.

Committee on Policy Meeting.

A plenary meeting of the Committee on Policy of *The Institute* will be held at Headquarters on Tuesday April eleventh, at ten o'clock a.m., and will continue in session until the various proposals which have been discussed by this Committee for nearly two years, can be brought to definite conclusions and recommendations to Council. This body is one of the most important of *The Institute*, since the Committee on Society Affairs, and its deliberations will doubtless influence *The Institute's* future to a considerable extent. The personnel of the Committee is such as to ensure a report embodying constructive suggestions based on good judgment.

With the addition of Councillors Duchastel and Thornton and H. H. Vaughan, Past President, the Committee on Policy is now constituted:—J. B. Challies, Chairman, A. B. Lambe, Secretary, A. R. Decary, Brig.-Gen. C. H. Mitchell, Walter J. Francis, K. H. Smith, J. G. Sullivan, A. E. Foreman, C. C. Kirby, A. B. Normandin, W. P. Wilgar, R. O. Wynne-Roberts, Wills Maclachlan, W. G. Swan, F. Peters, A. J. McPherson, J. A. Duchastel, K. B. Thornton, H. H. Vaughan.

C.I.M.M. Changes Policy

At the Annual Meeting of the Canadian Institute of Mining and Metallurgy held at Ottawa, on March first, second, and third, a complete discussion took place on the changes of policy proposed by Secretary-Treasurer George C. Mackenzie, resulting in their adoption, which will class this meeting as one of the most historic and important in the annals of C.I.M.M. meetings.

In his discussion on the proposals Mr. Mackenzie pointed out that to his mind, the Institute must adopt one of three definite policies. The first, to "proceed as at present, plodding along with uncertain gait and without a definite objective, quite content to exist as an organization which cannot be classed either as a professional or as an industrial society — a mixture of both, and without any well defined characteristics of either, which would entail a simple and placid existance for the future". The second would be to define the functions of the Institute as a technical organization, with certain prescribed and rigid requirements regarding membership, including adopting a code of ethics, and giving a definite professional standing to professional members. This, he believed, would cause the loss of support of the non-technical members, and require increasing the dues to twenty-five dollars, at least, per annum. The third proposal was the adoption of an industrial policy as already outlined by him.

Following the discussion a resolution and amendment were presented, both favouring Mr. Mackenzie's proposals. The resolution was unanimously passed.

> That this Annual Meeting go on record as approving the general principles of Policy as outlined in Mr. Mackenzie's address, and would urge upon Council the advisability of immediately supporting Mr. Mackenzie by such action as Council deems possible.

Since his appointment as Secretary-Treasurer Mr. Mackenzie has visited every mining district in Canada, with a view to finding out the general feeling towards the future of the Institute. As a result of his study of conditions, and having in view a solution of the problems facing the Institute, Mr. Mackenzie presented a report on "Institute Policy" published in the January "Bulletin". While the whole report is interesting, it is possible to publish merely extracts bearing upon the definite suggested policy. Mr. Mackenzie states:—

There is a strong under-current of feeling within the Institute that it is not functioning along the lines laid down in its charter. The charter provided us with a definite plan, but we are not following that plan, nor are we taking any steps to build an organization that will enable us to put that plan into effective operation. To be specific, many of our members consider that the Institute has developed into a pseudomorphic form, in which traces of the original structure are yet discernible, but which, to the uninitiated, resembles nothing more than a professional organization existing for the sole benefit of a particular class; and that, in consequence of this change, the Institute has been neglectful of its opportunities for growth and prestige in the service of industry.

The Charter of the Institute, adopted in eighteen hundred and ninety-eight, provided the following definite plan as a chart for the future guidance of the Society:

(1) To promote the arts and sciences connected with the economical production of valuable minerals and metals, by means of meetings for the reading and discussion of technical papers, and the subsequent distribution of such information as may be gained through the medium of publications.

(2) The establishment of a central reference library and a headquarters for the purpose of this organization.

(3) To take concerted action upon such matters as affect the mining and metallurgical industries of the Dominion of Canada.

(4) To encourage and promote these industries by all lawful and honourable means.

Note particularly that the Institute was organized for the purpose of representing and encouraging industry. There is no mention of assistance or protection for the individual, nor is there any comment upon the ethics of the profession of engineering. The individual and the profession are submerged in the hypothesis that if industry be served and fostered, the servants of industry will share in the benefits that must surely follow. A clear understanding of the foregoing, and acceptance of the fundamental that the Institute exists first and foremost for industry and is representative of industry, is necessary, because, if we follow this premise to its logical conclusion, we cannot decide otherwise than that the rights of the individual are secondary to the welfare of the industry. If this is granted, and it is difficult to deny in the face of the Charter, it may be possible to adopt a policy which, followed with persistence, should place the Institute in a stronger position than at any time in its history.

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There is, therefore, an important question of policy to be settled, and it must be studied from two standpoints:

(1) From the standpoint of the relationship between the Institute and the industry;

(2) From the standpoint of financing the Institute.

If we should decide to restrict membership in the Institute, following the lines adopted by our immediate predecessors and admitting to full membership only those persons possessing certain qualifications, then the Institute will develop slowly along pseudomorphic lines as formerly. If limited membership is desired and decided upon, it may be necessary to either give up the programme entered upon last year, or to increase the annual dues in amount sufficient to provide the necessary funds for that purpose. It should also be recognized that with a limited membership of professional or qualified men, the Institute will not possess the strength of a business organization necessary for influencing public opinion, and, as a consequence, neither the public nor the Government will be inclined to give serious attention to such a comparatively small group of men, whose society would be regarded as professional and existing for the benefit of a certain class of individuals rather than for the advancement of industry.

An alternative policy would be to follow to their logical conclusion the ideals expressed in the Charter: to develop the Institute along the lines of a powerful industrial society, whose first consideration would be the betterment of the industries of mining and metallurgy. If this policy be followed, then the doors of the Institute should be open to all who wish to become full members in a truly national organization.

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The broadening of the Institute policy on industrial lines may or may not require amendments to existing By-Laws. Should the Institute place itself on record in approval of a broad interpretation of the existing By-Laws governing membership, it is possible that succeeding Councils may follow the precedent thus established. I am inclined, however, to suggest that, if the Institute is convinced that a broad industrial policy is in the best interests of the Society, proper steps be taken to amend the By-Laws so that its industrial functions shall stand out very clearly.

Qualification for membership does not imply professional attainment, but rather conformity with the purpose of the Institute. Neither is full membership, or special classification of certain individuals, emblematic of the spirit of the Institute. One cannot do otherwise than agree with this view if the fundamental is accepted that the Institute was born in the interests of industry; and, granting that premise, the only logical conclusion one can arrive at is that qualification for membership must be of secondary importance to the service which the Institute is expected to render.

In case the purpose of this article should be misunderstood, I desire to say that I am not in favour of any quick change. I believe that a broad industrial policy should be shaped slowly and with deliberation. For the present, it is suggested that your Council interpret broadly the existing By-Laws governing membership, and that every opportunity be given candidates to enter the full membership class by eliminating the line of division between associate and full members. Does not the professional-member class afford sufficient distinctive tone to the Institute? I wish to emphasize again the fact that, if

the Institute is to expand logically along industrial lines, we must secure many more members from amongst the business men who have invested their money or are directing the investments of others, prospectors, salaried employees, and public spirited citizens — and, in fact, take in all reputable persons who wish to identify themselves with us. It is believed that a large number of new members could be secured if the Institute would accept them as full members and thus place all on the same footing.

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The Institute, in the performance of its function as a servant of industry, should strive for:

(1) Safety and efficiency in all mining and metallurgical operations.

(2) Intelligent conservation of mineral resources, together with the education of the public with the view of obtaining the highest development of these resources; thus stimulating investment by showing that legitimate mining is a profitable business.

(3) Sympathetic relations with the Federal and Provincial Governments for the improvement of mining legislation.

(4) Intelligent administration of such Federal and Provincial Mines Departments which deal with the industries of mining and metallurgy.

(5) Co-operation along all lines which lead to better conditions in the industries we represent, for improvements in production, treatment, transportation and exchange.

If our membership can be increased to the not impossible figure of five thousand, I would propose the adoption of a divisional system representative of provincial territories.

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How can this Institute, as it is organized at present, bring sufficient and convincing pressure upon the Federal Government to effect the adoption of an enlightened policy with regard to the Department of Mines at Ottawa?

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How can this Institute accomplish anything of tangible value to the industry garbed as it is with a coat and trousers of academic cut and a modest white waistcoat of professional tone? What we require is the adoption of an aggressive policy that will attract all classes of the mining public to our ranks, and we must put on a business suit of the cut and style which the public will recognize and understand.

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With the adoption of such a policy it is fondly hoped that those who have, in the past, been responsible for creating and tending to perpetuate feelings and sentiments calculated to keep the Canadian Institute of Mining and Metallurgy and *The Engineering Institute of Canada* apart, rather than as they should be doing, acting in the closest harmony, will realize that there can now be no conflict of interests, but that a spirit of mutual confidence, assistance, and co-operation should prevail to the fullest extent. This is, undoubtedly, the feeling of the membership of *The Engineering Institute of Canada* as to our relations with the Canadian Institute of Mining and Metallurgy, and it is certain that the goodwill of the members of *The Engineering Institute* will be gladly and freely given in the development of the aspirations embodied in the policy adopted at the Annual Meeting of the Canadian Institute of Mining and Metallurgy.

Presentation of Leonard Medals.

The following account of the presentation of the Leonard medals, supplied in advance by the courtesy of George C. Mackenzie, Secretary of the Canadian Institute of Mining and Metallurgy from the Proceedings of the Annual General Meeting, held on March first, second, and third, is of interest to members of *The Engineering Institute.*

"Through the courtesy of The Engineering Institute of Canada, the President was then enabled to make formal presentation of the "Leonard" medals for the years 1919, 1920, and 1921, for each of which years the Leonard Medal had been awarded to a member of the Canadian Institute of Mining and Metallurgy.

The Leonard Medal for 1919 was awarded to E. E. Campbell for his paper entitled "The Hidden Creek Mine and its Operations". An interesting feature of this medal is that it is made from pure gold obtained from the Coniagas Mine. Col. Leonard has informed us that a peculiarity of the Cobalt camp is that gold has rarely been detected in its ores, and that, as far as he is aware, the only commercial recovery of gold from Cobalt ores has been made in the electrolytic tanks at the Thorold smelter, where, in the refining of 41,000,000 ounces of silver there was recovered 25.4 ounces of gold. A medal similar in every way to that presented to Mr. Campbell has been kept by Col. Leonard as a souvenir. Mr. Campbell who is now with the United Verde Extension Mining Company, in Jerome, Arizona, was unable to be present and authorized Mr. Charles Camsell, deputy minister of mines, to receive the medal on his behalf.

The Leonard Medal for 1920 was awarded to The Staff of the International Nickel Company of Canada, Ltd., for their paper on "The Mining and Smelting Operations of the International Nickel Company of Canada, Ltd." J. C. Nicholls, the general superintendent of the company, accepted the medal on behalf of the staff, and expressed the appreciation of himself and his co-workers at having been awarded the medal.

The Leonard Medal for 1921 was awarded to John Ness, of the Imperial Oil Company, Ltd., for his paper on "The Search for Oil in the West". In making this presentation Dr. Corless said: "I remember, when sitting in the audience at the time the paper was read, saying to a neighbour that it was one of the most interesting I had ever heard. Civilization can only advance with knowledge, and Mr. Ness' paper was a most valuable contribution to our knowledge concerning the unknown resources of the great north-west." Mr. Ness accepted the medal with a few happy remarks, in the course of which he paid graceful tribute to his colleagues on the staff of the Imperial Oil Company, whose assistance, he said, had made the presentation of the paper possible."

Other Society Transactions

Following the announcement made in the January *Journal* advising our membership that arrangements had been made with the American Institute of Electrical Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Civil Engineers and the American Society of Mechanical Engineers, whereby our members receive the Transactions of these societies at the same price as that paid by their own members, the following table can be used as a reference of the various prices, the first column indicating the amount to be paid by the members of *The Engineering Institute* for the various publications.

	Rate to Member	Non-Member Rate
American Institute of Electrical Engineers		
Journal, single copies	$0.50	$ 1.00
" " per year	5.50	10.50
Transactions, per year, paper	5.00	10.00
" " " cloth	5.75	11.40
Year Book	1.00	2.00
Pamphlets	0.25	0.50
American Institute of Mining and Metallurgy		
Journal, single copies	0.50	1.00
" " per year	5.00	10.00
Transactions, per year, paper		
" " " standard binding	4.00	8.00
Other Publications, 50% reduction on catalogue price to E.I.C. Members)		
American Society of Civil Engineers		
Proceedings, single copies	0.40	0.75
" " per year	4.75	8.75
Transactions, per year	6.00	12.00
(Other Publications, 50% reduction on catalogue price to E.I.C. Members)		
American Society of Mechanical Engineers		
Journal, single copies	0.25	0.30
" " per year	3.50	4.50
Transactions, per year	6.00	11.00
Year Book	1.00	2.00
(Other Publications, same rate to E.I.C. Members as to A.S.M.E. Members)		
Engineering Institute of Canada		
Journal, single copies	0.25	0.40
" " per year	2.00	3.00
Transactions, per volume	1.50	3.00
Year Book	0.75	1.50
Pamphlets	0.25	0.40

Special Water Power Lectures at University of Toronto

In order to supplement in an effective way the courses in water power development which have been a part of the curriculum in engineering in the University of Toronto for many years, arrangements were made this session for a short series of lectures to be given by five prominent Canadian and American hydraulic engineers. The importance of developing our water powers has long been recognized and the hydraulic courses have always been shaped with this problem in view, and also with an idea of training engineers for water supply and irrigation.

After consideration it was thought best to deal with the water power development only, because sufficient time was not available without making the course much longer than was thought advisable at the present time of year.

In arranging the course, Professor R. W. Angus, M.E.I.C., head of the Department of Mechanical Engineering, under which the hydraulic work is done, invited five very prominent men who have become recognized authorities in a special field of the work, each of whom dealt with a different phase of it, so that in a brief way the whole problem of water power development was viewed from different angles and each detail received consideration.

From the outset the course was designed to be of particular value to advanced students and to practising engineers, so that the lectures were technical, rather than descriptive, and were of special interest to Fourth year men, but were also enjoyed by large numbers from the Third year as well.

Although the lectures chanced to come on the same week as the Engineering Society elections, which always take up much of the student's thought and attention, the attendance ranged from two hundred to three hundred on every occasion.

Addresses by Lewis F. Moody, Philadelphia.

The course opened with two lectures on Feb. 27th by Lewis F. Moody, a graduate of the University of Pennsylvania, and for some years professor of Hydraulics in Rensselaer Polytechnic institute, but now consulting engineer for the I. P. Morris Department of William Cramp and Sons Ship and Engine Co., Philadelphia.

Under the headings "Some of the principles controlling the use and design of hydraulic turbines" and "Hydraulic turbines and Installations", Mr. Moody presented very difficult theory of the turbine in a concise form, deriving the necessary equations and illustrating his work by slides and sketches. He also gave a large number of slides showing the very latest turbine designs and illustrating the new high speed turbine, in the development of which he has taken a prominent part. A brief summary of this lecture has been printed elsewhere.

The new forms of draft tube, mainly designed by Mr. Moody and applied to some of the largest plants in the world were fully discussed and their theory explained, although the speaker carefully concealed his connection with the inventions.

Address by Max V. Sauer, M.E.I.C.

The address by Mr. Sauer, M.E.I.C., a graduate of the University of Toronto, and hydraulic engineer of design for the Hydro-Electric Power Commission of Ontario, dealt with the general considerations affecting the power house design and layout and the speaker discussed various details of the plant. Starting with the selection of the turbine for a particular duty, Mr. Sauer discussed the exciters, governors, oiling systems, and other auxiliary equipment laying much stress on the factor of reliability which he regarded as more important than even the efficiency. The need of reliable oil pumps and air compressors was stressed and many practical points were mentioned.

During the discussion which followed, many other points were brought forward and the session proved profitable and interesting.

Address by T. H. Hogg, A.M.E.I.C.

The next phase of the development dealt with was the consideration of the Intake, Head Works, Power Canal or Conduit, Surge Tank and Penstock, and T.H. Hogg, A.M.E.I.C., assistant hydraulic engineer for the Hydro-Electric Power Commission of Ontario treated the matter in a most capable way. Having outlined some of the troubles due to ice, he explained the principles governing the intake design and next took up the matter of the canal itself, outlining the general method of handling the problem and giving many helpful ideas and suggestions as to how such a difficult problem could be solved, incidentally commending the methods now being taught at this University.

The problem of the surge tank took a fair share of Mr. Hogg's time, and he showed why it was needed and worked out some problems, supplemented by his experience, to show how important it is to make proper allowance for surges. All that was possible was to indicate the method of solution, both this problem and the former one being examples of the use of arithmetical integration.

Address by W. M. White.

The address by W. M. White, hydraulic engineer for the Allis Chalmers Co., Milwaukee, a graduate of Tulane University, proved a most valuable one. Mr. White had just returned to America after an extended trip in Japan, Formosa and the east, and spoke in a very interesting way of the developments in those countries in the hydraulic line, pointing out that they were realizing the very great value of water power in the progress of their nations.

Mr. White discussed primarily power house machinery showing how the draft tube affected the design and discussing the best form of the tube and the experiments that lead to his conclusions. He also discussed the modern turbine development at some length and showed how the power house could be much simplified in good design, and also gave some interesting illustrations of how the best advantage may be taken of the head and volume and described some exceedingly novel power houses. His company was the only one, he said, which had supplied the most recent form of high speed runners to actual plants.

Addresses by N. R. Gibson, M.E.I.C.

The two concluding lectures were given by N. R. Gibson, M.E.I.C., a graduate of the University of Toronto in 1902, and at present hydraulic engineer for the Niagara Falls Power Co., Niagara Falls, N.Y. Mr. Gibson has brought some distinction recently to his alma mater by two important researches, of recognized merit.

In his afternoon address Mr. Gibson dealt with the regulation and testing of turbines, and set out fully how the problem of regulation was affected by the dimensions of the pipe line and penstock and also by the changes of load. He then discussed at length the importance of efficiency determinations and the reasons why these must be made with accuracy, but at the same time he showed how difficult it was to measure some of the elements, more particularly the quantity of water flowing. Mr. Gibson's simple and precise solution of this problem is well known to engineers and is likely to be almost universally employed; his description of it, therefore, proved of much interest.

The concluding lecture on the evening of March 6th was also by Mr. Gibson, and in it he discussed the economic features of water power development, explaining the conditions where water power is preferable to steam, the meaning of rates, the effect of the "diversity factor" and many other of the very important points connected with the sale of power. He concluded his lecture by a splendid set of slides showing the progress being made by his Company with the new tunnel at Niagara Falls, and also the advances made in hydraulic machinery, as illustrated in the plant he is connected with.

Very general satisfaction has been expressed everywhere with the entire course of lectures, both by engineers and students, and the results have fully justified the effort put forth. Those who so kindly gave of their time and ability to deliver the lectures have very deservedly earned the gratitude of this University.

OBITUARY

Hon. Geo. R. Smith, M.E.I.C.

The death took place on February 20th, at Thetford Mines, Que., of the Hon. Geo. R. Smith, M.E.I.C. Mr. Smith was born at Newark, N.J., on February 17th 1860. He came to Canada in connection with the mining industry in the Ottawa region. The asbestos deposits were beginning to attract general attention and in their development he became active. He held the position of vice-president and general manager of Bell's Asbestos Company, at Thetford Mines, and was vice-president and general manager of the Asbestos Manufacturing Company of Montreal. He was one of the founders of the Canadian Mining Institute, of which he was for some time president. When he retired in 1907, the Council of the Institute presented him with a silver tea service in acknowledgement of his services. He was interested also in other commercial enterprises and was a member of the Montreal Board of Trade. He was elected a Member of *The Engineering Institute of Canada* on October 24th, 1907.

Mr. Smith sat in the Legislative Assembly for Megantic from 1897 till 1909, and took active interest in elementary educational work in the province, in 1911 he was appointed a member of the Legislative Council. He married in 1886, Isabella Frances, daughter of Mr. George L. Parker of Buckingham, and is survived by his widow, two daughters and five sons.

EMPLOYMENT BUREAU

AND

MEMBERS' EXCHANGE

To make this department more valuable it is proposed that in future advertisements of situations vacant should state salary, and give details of requiremenfs.

Situations Wanted

Civil Engineer

Fourth year Toronto student open for engagement, preferably in Toronto. Civil engineer experience with six months at the Experimental Station of the Provincial Board of Health of Ontario. Apply Box 91-P.

Transitman and Draftsman

Transitman and draftsman, S.E.I.C., desires position in field. Experienced in mining and water power surveying. Free to commence May 1st. Apply Box 92-P.

Civil Engineer

Civil engineer with six years railway experience seeks position preferably in Ontario, but will go anywhere. Apply Box 93-P.

Civil Engineer

Civil engineer, A.M.E.I.C., college graduate, 32 years old, desires to get in touch with firm specializing in reinforced concrete design and construction. Experience in water power investigation, dam and power plant construction, concrete construction and municipal engineering in Nova Scotia, Toronto, Middle West and B.C. Particulars and references on request. Apply Box 94-P.

Members' Exchange

For Sale

Report of 7th International Congress of Applied Chemistry. Report of 8th International Congress of Applied Chemistry, Volumes 1 to 27. Transactions of the Electro Chemical Society, from 1902-1914 inclusive. Apply Box 23-A.

Level for Sale.

Buff and Buff 15½" engineer's dumpy level. Complete with tripod and mahogany case. Level has clamp and tangent screw. Telescope has inverting eye piece. Apply Box 25-A.

Time Saving Charts.

A member of *The Institute* has prepared for the use of engineers, architects, contractors and others interested in reinforced concrete, charts for reinforced concrete beams and columns, which will prove valuable time savers to all having to do with reinforced concrete design in any way.

The bending moment of the beam having been found, in foot pounds, by referring to the chart, the nearest figure on the curved line corresponding to the bending moment will give the size of the beam required in inches for the depth and width, and will also show the square inches of steel required in the bottom portion of the beam. After the size is chosen, the extra reinforcement required to take any additional strains will have to be again calculated, but this is a simple matter. The number of rods required, and the size of same, will be governed by the width of the beam, and the spacing of the rods, either in square, or irregular beams, easily determined. The beam chart shows in the left hand lower corner examples of a beam to be used, the bending moment having been first calculated. Data for additional strains are also worked out.

Attached to the beam chart, is an example of a floor, with method of calculating the bending moment, and the requisite beam to support same, giving sizes required as also the area of steel. In both cases the strains in the steel and concrete are similar, proving conclusively the correctness of the calculations and the curve lines. The vertical and horizontal lines give respectively the depth and width of beam in inches, and the curved lines the bending moment in foot pounds, and the area of steel required in square inches.

(The method of placing the steel rods, their connections, and necessary stirrups, will be governed entirely by the architectural design, a fixed rule being a hard matter to give.)

The column chart shows the sizes in inches, either for square or irregular columns, required to support a given load, shown on the curved lines, also the square inches of steel for the vertical rods, the method of tying the rods together being a detail to be chosen by the designer. (These charts will be a time saver for preliminary work, and will allow any building designer to find out at once the sizes required to suit the head room, and other fixed measurements.)

The charts are available for ten dollars a set of three blue prints, and will be mailed to anyone desiring same by addressing Box 26A.

List of student members at Queen's University requiring summer employment,

The Engineering Society of Queen's University desires to announce the establishment of a permanent Employment Service. It will give employers of technically trained men complete and reliable information regarding graduates and undergraduates.

Listed below are some of the students desirous of obtaining employment in May. Almost all have expressed their willingness to do [illegible] Full information regarding any of these men may be obtained promptly from the Manager of the Engineering Society Employment Service, Kingston, Ontario.

Name	Work preferred	Experience
Civil Graduating Class		
Emery, D. J.	Reinforced concrete construction.	4½ yrs. foreman reinforced concrete construction, railroad, surveying, drafting, ass't. eng'r. G.T.R. arbitration, 4½ yrs. overseas in C.E. (M.C., M.M.).
Walker, G. S.	Highway or railway work.	4 yrs. ass't. to D.L.S.; 1 yr. N.T.R. cross section; 5 mos. instrument' man, dept. Highways; 4 yrs. overseas C.E.
Greenwood, W.	Waterpower or highway work	11 mos. geological survey; 2 yrs. overseas; 11 mos. instrument man.
Deamude, F. V.	Structural, reinforced concrete or municipal	7 mos. topographical survey; 3 mos. reinforced concrete; . mos. railway location; 5 mos. machine shop; 2 yrs. overseas.
Tully, D. J.	Reinforced concrete, structural	2 mos. plane table, irrigation surveys, 10 mos. stadia surveys.
Wallace, A. M.	Construction work, buildings or roads, office or outside work. Surveying	6 mos. foreman of labourers on concrete work.
Paoli, A. A.	Operation of electric steel furnaces or open hearth, superintending operation or construction of same	1 yr. Moreland Motor Truck Co., supervising manufacture of iron and steel; night sup't. Charleton Alloy Steel Co. for 7 mos., 2 yrs. smelting of steel.
Poyser, B. D.	Reinforced concrete	1 yr. construction of concrete bldgs.
M[illegible], H. R.	Municipal or with Consulting firm. Reinforced concrete work	Ass't. Eng'r. City of Stratford. Charge of paving, 12 mos.
III Year Civil		
Meatherell, J. N.	Construction work; highway construction; draftsman	5 mos. rodman on survey.
Currie, V. R	Reinforced concrete construction, surveying	5 mos. county road commissioner.
Swift, E. R.	Instrument work; construction	5 mos. rodman on maintenance of way; 3 yrs. overseas.
MacDonald, N. T.	Electrical work, either maintenance or construction; surveying	5 mos. in charge of rolling mills; 1 yr. electrician's helper on construction on Chippawa Canal; 5 mos. lineman.
Sutherland, N. C.	Bldg. construction; road construction; surveying	3 mos. contracting; 4 mos. investigation of iron property; 5 mos. ass't. magnetometric survey; 3 yrs. overseas.
Rousell, F.	Construction work; steel or cement highway	5 mos. concrete inspector on highways; 3 yrs. overseas.
Koen, J. D.	Surveying rodman, geological survey; provincial highway	5 mos. rodman on survey.
Robertson, D. G.	Civil engineering	5 mos. dep't. Public Highways, Ont.
Burns, R. P.	Construction work; mech'l. work; surveying	23 mos. overseas; 5 mos. rodman on survey.
Marlatt, C. E.	Construction	5 mos. assistant to flotation expert, research lab.; 5 mos. sampler in flotation mill, assistant to surveyor.
Ludgate, J. V.	Engineering work, chiefly outdoor work	5 mos. survey as rodman; 5 mos. rodman, axeman, asst. transitman.
Sutherland, N. C.	Construction, highways, or survey parties.	5 mos. assistant on investigation of iron properties; 5 mos. assistant on magnetometric survey.
IV Year Electrical		
Detlor, W. K.	Shop work.	5 mos. assembling transformers and winding transformers.
Saunders, J. B.	Shop work.	5 mos. armature winding and assembling motors; 5 mos. electrical helper, stock keeping; carried on electrical contracting business in square time from 1917 to present; wired Queen's stadium.
III Year Electrical		
Hicks, A.	Machine or electrical shop work.	
Cockburn, J. M.	Electrical work	5 mos. munition work.
Nayler, J. B.	Electrical or machine shop work.	5 mos. machine shop and garage work; 3½ yrs. overseas (M.M.).
Climo, C.	Electrical work	2 mos. asst. dyer; 2 mos. foreman in canning factory; 1 month dredging inspector; 2 yrs. overseas in heavy battery.
Affleck, W. E.	Electrical work	Several months miller and foreman in flour mills; 3 mos. subforeman on telephone plant; 3 mos. electrician's helper in power plant.
Jones, V. C.	Designing or testing motors and generators	7 mos. draftsman for a.c. motors and generators; 28 mos. overseas in C.F.A.
Baker, A. J.	Power plant work or hydro construction	2 yrs. machine shop experience and car barn work (wiring and motor repairing).
Rose, D. C.	Electrical work in industrial plant.	4 mos. drafting; some wiring.
Collyer, E.	Work in power house	6 mos. electrical work (wiring).
Bastedo, T. F.	Machine shop work	4 mos. machinist in automobile factory.
Murray, J. D.	Electrical experience	House wiring; 4 mos. time keeper; bolter up, etc., in shipbldg. co.
Bracken, W. D.	Electrical work	5 mos. hydro-electric system, inspector in the overhead pole lines in the city of Toronto.
Taggart, H. A.	Electrical work	3 mos. coil winding for electrical co.
II Year Electrical		
Appleyard, C. E.	Electrical work.	2 yrs. Royal Navy; 5 mos. steel plant.
Murphy, C. B.	Electrical work.	5 mos. foreman on bridge construction.
Cross, D. M.	Electrical work.	10 mos. general work in factory.
Tkachyk, J.	Electrical work	5 mos. chainman and topographer on preliminary and location.
Thompson, M. L.	Electrical work	11 mos. general factory routine.
McKenzie, W. M. K.	Electrical work	Three years overseas with "Princess Pats".
Currie, E. B.	Electrical work	6 mos. time keeping.
Lyons, G. S.	Electrical work	2 yrs. telephone installation and switchboard repairman.
IV Year Mechanical		
Clench, R. J.	Machine shop work	5 mos. shop work; 5 mos. shell inspector; 2 yrs. overseas, in R.F.C.
Roy, E. W.	Training along production engineering lines	3 yrs. machinist in iron works; 5 mos. asst. chief inspector in machine shop.

Name	Work preferred	Experience
Wilson, D.	Drafting or construction work	5 mos. garage work; 5 mos. geological survey; 5 mos. shop work.
Young, J. P.	Machine designing or mechanical drafting	3 yrs. machine shop; 1½ yrs. mechanical drafting office; 39 mos. overseas in C.G.A.
Bulmer, C. E.	Mechanical engineering	5 mos. machinist's apprentice.
III Year Mechanical		
Rapley, B. P.	Machine shop work	
MacKay, R.	Machine shop work	6 mos. rodman; 3 mos. office work.
Moulton, R. H.	Mechanical or electrical work	4 yrs. office work.
Aitkin, R. J.	Mechanical or electrical work	18 mos. designer and draftsman with car company; 4 mos. steel detailer on elevator construction; 2 yrs. 9 mos. machine repairs, shop work, construction work; 11 mos. mould loftsman and foreman on steel erection in shipyard; 5 mos. pulp and paper plant.
Warner, G. W.	Shop work	General knowledge of steam and internal combustion engines.
Morrison, N. A.	Mechanical work	
Minnes, V. A.	Machine shop work	2 mos. transmission dept. of automobile plant; 4 mos. motor assembly automobile plant; 6 mos. shipbuilding plant; 2 yrs. overseas.
Hipwell, J. E.	Machine shop work	9 mos. in automobile plant on motor manufacture.
Dawson, W. A.	Ass't. to mech. engineer in tool room.	5 yrs. tool and die maker on naval ordnance work and dies for intricate parts.
Lewis, W. M.	Machine shop work	7 mos. shell inspector; 5 mos. oiler and assistant engineer on lake boat; 4 yrs. school teacher; 2 yrs. on railroad construction.
Hay, N. M.	Mechanical drafting office	1 yr. automobile factory; 9 mos. G.T.R. shops; 2 yrs. garage and business experience; 3 yrs. overseas in R.F.A.
Sully, E. A.	Machine shop practice	5 mos. machine shop work in electric plant.
Kennedy, T. W.	Engine or automobile plant; drafting	5 mos. machine shop practice.
Showers, C. G.	Steam fitting	10 mos. ass't. to millwright, pipe fitter and general maintenance.
Halliday, H. J.	Machine shop work	10 mos. machinist production work.
II Year Mechanical		
McNeil, R.	Machine shop work, paper mill	5 mos. oiler and millwright's helper.
Brown, G. H.	Concrete inspection work and machine shop experience	5 mos. chainman in survey; 5 mos. construction work.
Edwards, H. J.	Machine shop practice	5 mos. labourer provincial highways; 10 mos. tire and rubber co.

List of student members of the Toronto Branch requiring summer employment.

Name	Address	Year	Dept.	Work desired	Experience	Remarks
C. H. Carslake	10 Smith St., Toronto, Ont.	Grad'g	Chem. eng.	Any industry in which engr'g. chem. etc., or engineer'g. train'g. is necessary.	4 yrs. carpentering and bldg., 6 mos. in charge of construction work	3½ yrs. overseas willing to star at bottom.
R. H. B. Cook	Box 509, Aurora, Ont.	Grad'g	Civil	Municip'l., sanitary or highway	1 sum. Tor. Harb. Com. instrument man; 1 sum. as inspt'r Prov. Board of Health.	Returned soldier; location immaterial.
F. C. Ball	168 Adelaide St., Toronto, Ont.	3	Civil	Struct'l. or highway		
S. T. Franks	2314 Scarth St., Regina, Sask.	3	Electrical	Electric'l. or other construction	5 mos. transmission line construction; 3 mos. Railways construction 6 mos. road surveys	
R. T. Lyons	10 Withrow Ave., Toronto, Ont.	3	Civil	Concrete preferably	Insp. for Ont. Public Highways.	
J. M. Smith	Durham, Ontario	3	Civil	Struct'l. or survey'g.		
P. E. Baumann	568 Crawford St., Toronto, Ont.	3	Civil	Geolog'l. or geodetic survey'g.; irrigat'n.	With Swiss Federal Railway, dept. of hydro-elec. drainage and levelling.	Would go to Rocky mountains, 5 yrs exp. mountr'g.
K. C. Siddall	Islington, Ontario	3	Civil	Steel or conc. constrn. design'g., estimat'g. or survey'g.	3 mos. highway wrk.; 6 mos. conc. brdge wrk.; 2 mos. survey'g.	
J. C. Higbee	189 Huron St., Toronto, Ont.	3	Civil	Steel or conc. constrn. surveying.	5 mos. instrumt'man.	
H. A. McKay	119 Essex Ave., Toronto, Ont.	3	Civil	Survey'g., highway or reinf. concrete	3 mos. struct. steel shop; 2mos. rein. conc. constrn. 3½ mos. struct'l. steel co., as draughtsm'n.	
R. C. Leslie	304 Windermere Ave., Toronto, Ont.	3	Civil	Any sort of engineer'g. work.	3 yrs. house constrn.	
P. C. Davidson	583 Bathurst St., Toronto, Ont.	2	Chem.	Travel'g. or chemic'l. eng. wrk. in Toronto.	Factory labour, quarry wrk. and mine wrk.	
J. H. Ings	52 Albany Ave., Toronto, Ont.	2	Civil	Constrn. or survey'g.	2½ mos. C.N.R. surveys; 4 mos. Dominion Ship Bldg. Co.	
C. T. Sharpe	75 Jameson Ave., Toronto, Ont.	2	Civil	Railr'd. survey'g., or constrn. work	5 mos. as blaster at Hollinger Gold mines.	Returned soldier.
K. V. Heyland	441 Gladstone Ave., Toronto, Ont.	2	Civil	Construction	7 mos. lumber shipper.	
T. D. Churchill	72 Indian Road, Toronto, Ont.	3	Electrical		3 mos. Bell Telephone Co; 15 mos. Marconi Wireless Co.	
A. W. McQueen	Nottawa Simcoe Co., Ont.	4	Mech.		9 mos. struct. work-Collingwood Shipbuilding Co; 12 mos. heat treatment on shells; 5 mos. machine shop work	

Elections and Transfers

At the meeting of Council held on March 21st, 1922, the following elections and transfers were effected:—

Members.

Claude C. Curtis, B.S. (M.E.) (Univ. of Mich), manager, Cape Breton Electric, Co. Ltd., Sydney, N.S.

Albert Dawes, div'l. engr., Nova Scotia Steel & Coal Co., Ltd., Sydney Mines, N.S.

Louis Elgin Jones, (Univ. of Toronto 1911), asst. engr., Dept. Public Highways, Province of Ontario, Toronto, Ont.

Godfrey Dean Rhodes, (Grad. R.M.C.), chief engr., Uganda Rly., Nairobi, King's Colony, East Africa, (Major, Royal Engrs.)

Frank Newman Speller, B.A.Sc. (Univ. of Toronto), metallurgical engr., National Tube Co., Pittsburg, Pa.

Associate Members.

Charles Mills Ainslie, Major, Garrison Engr., Military Works Service, Poona, India.

John Vickers Angus, asst. gen. mgr., Armstrong-Whitworth of Canada, Limited, Montreal, Que.

Claus Marius Bang, B.Sc. (M.E.) Polytechnical Academy, Copenhagen, designer on engr'g. staff, Wayagamack Pulp & Paper Co. Ltd., Three Rivers, Que.

Thomas Arthur Barnett, gen. supt., Twin Falls power house and dam, for Morrow & Beatty, Falls View, Ont.

Frank Bowness, asst. foreman, dfting. dept., Can. Gen. Elec. Co., Peterborough Ont.

Leon Brunet, C.E. Polytechnic School, Montreal. senior asst. engr. in charge of engr'g. staff, Dept. Public Works, Quebec.

Chester Scott Clendening, res. engr., Lethbridge Northern Irrigation District, Lethbridge, Alta.

Arthur Gibb Cushing, B.Sc. (McGill Univ.), asst. supt., gas distribution dept., Montreal Light, Heat & Power Co., Montreal, Que.

Thomas Clinton Dennis, B.Sc. (McGill Univ.), geodetic engr Geodetic Survey of Canada, Ottawa, Ont.

Ovide Cyrille Edouard Fournier, B.A.Sc. (Laval Univ.), 1st asst., drainage location party. Reclam. Service, Dept. Interior, Ottawa, Ont.

Manfred Freeman, commissioner of public utilities, City of Lethbridge, Alta.

Richard Dobson Harper, district engr., Good Roads Board, Winnipeg, Man.

Franklin Ernest Holland, C.E. (Cornell Univ.), sales engr., Sherwin Williams Co. of Canada Ltd., Montreal, Que.

Eric Ian Henry Ings, (Grad. R.M.C.), instr'man., Lethbridge Northern Irrigation District, Lethbridge, Alta

John Hayes Jenkinson, manager, The Dominion Tar & Chemical Co. Ltd.. Sault Ste. Marie, Ont.

John Frank Lawrence, B.Sc. (McGill Univ.), supt. of shops, Laurentide Co., Grand Mere, Que.

Maurice Frank Ronald Lloyd, canal supt., Lethbridge Section, C.P.R., Irrigation Branch, D.N.R., Nagrath, Alta.

Hector MacNeil, B.Sc. (Mass. Inst. Tech.), C.N.R., Saskatoon, Sask.

Enos Maybee, foreman, dfting dept., Can. Gen. Elec. Co., Peterborough, Ont.

William L. McKenzie, owner and mgr., W. L. McKenzie & Co., Electrical Engrs., Lethbridge, Alta.

Harold Arthur Morey, B.Sc. (Dartmouth Univ.), mill. engr., Spanish River Pulp & Paper Mills Ltd., Sault Ste Marie, Ont.

William Burnthorne Musgrave, B.Sc. (Queen's Univ.), office engr., Division No. 1, Chippawa-Queenstown Power Development, H.E.P.C. of Ontario, Chippawa, Ont.

Kenneth Hutchinson Smith, private practice, Wolverhampton, England.

Raymond Robert Stevenson, B.Sc. (Univ. of N.B.), junior engr., Welland Ship Canal, Thorold. Ont.

Duncan Gair Sutherland, contracting engr., Winnipeg Electric Rly. Co., Winnipeg, Man.

William McKay Sutherland, checker and designer, Dominion Coal Co., Glace Bay, N.S.

Aubrey Clifton Tabor, B.Sc. (Univ. of N.B.), of Fredericton, N.B.

Wilfred Gordon Ure, B.A.Sc., (Univ. of Toronto), member of firm, F. J. Ure & Son, Civil Engrs. and Surveyors, Woodstock, Ont.

William Martin Veitch, special asst. in charge of design of sewers and disposal plants for City of London. Ont.

H. Alton Wilson, (Univ. of Toronto "11), technical editor of engineering publications, Montreal, Que.

Juniors.

Thomas Bristol Bradley, instr'man., Section No. 5, Welland Ship Canal, Welland, Ont.

Frank Harold Emmerson, in charge of dfting room, section No. 3, Welland Ship Canal, Thorold, Ont.

F. Darrell Gifford, district vocational officer in charge of Peterborough District, D.S.C.R., Peteborough, Ont.

Earl Alexander Gray, asst. engr. Public Utilities Commission, London, Ont.

John A. C. Johnston, dftsman, Dominion Coal Co., Ltd., Glace Bay, N.S.

Gordon McIntyre, B.Sc. (McGill Univ.), chemist, Imperial Oil, Limited, Regina, Sask.

John Stewart Mewburn, instr'man., Welland Ship Canal, Niagara Falls, Ont.

John Clarence Mitchell, B.A.Sc. (Univ. of Toronto), acting sec.-treas., Webster Constrn. Co. Ltd., London, Ont.

William Herbert Nixon, B.A.Sc. (Univ. of Toronto), res. engr., Toronto and York Commission, Toronto, Ont.

Ambrose Aloysius Paoli, B.A. (Queen's Univ.), 4th year student Queen's University, Kingston, Ont.

Allan Hugh Russell, asst. to city engr., Sault Ste Marie, Ont.

James Frederick Shelton, dftsman, Welland Ship Canal, Thorold, Ont.

Associates

Frederick Denille Burpee, mgr., Ottawa Electric Railway, Ottawa, Ont. Erle E. Eisenhauer. B.S.A. (Univ. of Sask.) instructor in irrigation in the prov. schools of agriculture at Raymond & Gleichen, Alta.

Gilbert J. P. Jacques, private practice architect and engineer, Windsor, Ont.

Duncan Angus MacLean, constrn. eng., Dominion Iron & Steel Co., Sydney, N. S.

Transferred from the class of Associate Member to that of Member.

James Aubrey, Burnett, Contltg. & Appraisil engr., Smart & Burnett., Montreal, Que.

John Goodwill Macphail, BSc. (Queen's Univ.), commissioner of lights, Marine Dept., Ottawa, Ont.

Dominic Edward O'Brien, C.E. (Univ. of Toronto), senior asst. engr., Welland Ship Canal, St. Catharines, Ont.

George Linton Watson consltg.-engrs., New York, N.Y.

George Clark Wright, B.Sc., (Queen's, engr., and vice-president Kingston Constrn.. Co. London, Ont.

Transferred from the class of Junior to that of Associate Member.

Leonard Edgar Allen, Civil Service, Ottawa, Ont.

Richard Griffith Boast, B.Sc., (McGill Univ.), engr. mtce of way, T. & N.O. Rly., North Bay, Ont.

Walter George Hunt, B.Sc. (McGill Univ.), constrn. engr., Laurentide Co., Grand Mere Que.

William Earle Longworthy, B.A.Sc. (Univ. of Toronto), sewerage engr., City of Regina, Sask.

Augustin Jean Papineau, C.E. (Ecole Polytechnique), local mgr. at Amqui, for St. Lawrence Lumber Co. Ltd.

Alexander Pirie, asst. engr., Dom. Water Branch, Vancouver, B.C.

Rupert Harrington Reif, B.Sc. (McGill Univ.), Hollinger Mining Co., Timmins, Ont

Robert Donald Thexton, asst. engr., Eastern Constrn., Nigerian Rly., Enugu, British West Africa.

Transferred from the class of Student to that of Associate Member.

Charles Alexander Doherty, sub-area officer, rank of Major, Civil Service Air Ministry, Hitchin, Herts, England.

Guy Adamson Lindsay, B.Sc. (McGill Univ.), hydraulic engr., St. Lawrence River Improvement Investigation, Dept. of Rlys. and Canals, Ottawa, Ont.

Charles Clarence Rance, B.A.Sc. (Univ. of Toronto), ass . engr., H. T. Routly, Toronto, Ont.

Andrew Murray Robertson, B.Sc. (McGill Univ.), divisional traffic engr., Bell Telephone Co., Montreal, Que.

Transferred from the class of Student to that of Junior.

Pierre Maurice Chaussee, chief dftsman., Montreal Water Board, Montreal, Que.

Arthur James Edward, B.Sc., (McGill Univ.), chem. engr., in operation of St. Maurice Lumber Co., New Mill, International Paper Co., Three Rivers, Que.

Charles Errington, (Grad. R M.C.), hydrometric recorder, Dominion Water Power Branch, Dept. of the Interior, Calgary, Alta.

John Austin Loy, B.Sc. (McGill Univ.), inspr., Dept. of Public Highways, Ontario, Ottawa, Ont.

Gordon Leslie Mackenzie, B.Sc. (Queen's Univ.), associated with J. E. Underwood, Consltg. Engr., Saskatoon, Sask.

Alphonse Trudeau, B.Sc., (McGill Univ.), of Ste Anne de Bellevue, Que.

PERSONALS

Merle J. Ker, Jr.E.I.C., has been appointed engineer to the Township of Stamford.

Geo. E. Stephenson, Jr.E.I.C., has been appointed engineer of Bruce County, Ont.

F. N. Sinclair, A.M.E.I.C., is now chief engineer of Sumas Dyking District, Kilgard, B.C.

Lieut.-Col. W. G. Tyrrell, D.S.O., M.E.I.C., has moved from Ireland to Paignton, S. Devon, England.

John Buss, S.E.I.C., formerly at Mille Roches, Ont., is now with the Bogalusa Paper Company, Inc., at Bogalusa, La.

Lt.-Col. H. D. St. A. Smith, D.S.O., A.M.E.I.C., recently returned to Calgary from Mesopotamia, where he was engaged in irrigation work.

Donald M. McLean, Associate E.I.C., is now on the engineering staff of the Dover Boiler Works at Dover, N.J.

C. B. Kingston, M.E.I.C., is now with the African and European Investment Company Limited at Johannesburg, South Africa.

Captain R. D. Thexton, F.R.G.S., Jr.E.I.C., has been appointed assistant engineer, Eastern Construction, Nigerian Railway, British West Africa.

W. L. Ball, A.M.E.I.C., has been transferred to the office of the engineer of Standards, Canadian National Railway, Old Union Station, Toronto, Ont.

H. W. Perkins, A.M.E.I.C., formerly of Toronto has accepted a position in the Highway Department of Minnesota is now resident in St. Paul, Minnesota.

Fred Clark, A.M.E.I.C., has been appointed superintendent of the Lethbridge Northern Irrigation Project with Grant Smith and Company and McDonnell Limited, contractors.

James Adam, A.M.E.I.C., formerly with the Department of Civil Re-Establishment has secured a position with the Tropical Oil Company at Cartagena, Colombia, South America.

P. A. Landry, A.M.E.I.C., has been appointed representative of the Curry Cormac Corporation Limited dealing in machinery supplies at Room 4, 288 St. James Street, Montreal.

H. A. Terrault, A.M.E.I.C., superintendent engineer in charge of the workshops and yards and fuel supervision of the sewer pumping system has been appointed by the City of Montreal.

W. B. Crombie, A.M.E.I.C., formerly with Morrow and Beatty Matheson has excepted a position in the Forestry Department of the Abitibi Power and Paper Company, Iroquois Falls, Ont.

M. C. Garroni, A.M.E.I.C., of Winnipeg is sailing from New York early in April for a lengthy trip to the Mediterranean. Mr. Garroni expects for the next six months to be resident in Malta.

A. C. D. Blanchard, M.E.I.C., a member of the Niagara Peninsula Branch gave an illustrated address on the Queenston-Chippawa Power Development to the Peterborough Branch on the 9th of March.

L. W. Wynne-Roberts, A.M.E.I.C., has severed his connection with the Ontario Department of Public Highways and has been appointed manager of the Chatham office of Frank Barber and Associates, consulting engineers.

A. W. McMaster, A.M.E.I.C., whose paper on Silica Brick was published recently in *The Journal* has been appointed assistant general sales agent of the Dominion Coal Company Limited and is now resident in Montreal.

W. E. Walsh, Jr.E.I.C., has severed his connection with R. McDougall Company Limited, Galt, Ont., and has accepted the position as junior mechanical engineer with The Canadian Crocker Wheeler Company Limited, at St. Catharines, Ont.

A. G. Hill, A.M.E.I.C., has opened an office in Kent Building, Toronto, as mechanical and civil engineer. He has been appointed representative of a number of engineering firms dealing in boiler power house equipment, air compressors, steam engines, and rock crushing equipment, etc.

Past-President Dr. Martin Murphy, M.E.I.C., suffered the loss of a son, and John J. Murphy, A.M.E.I.C., of the Ottawa Branch, and M. J. Murphy, A.M.E.I.C., Secretary-Treasurer of the Moncton Branch, a brother, in the death at Montreal on February 25th, of Martin Murphy, Jr.

W. G. A. Adams, A.M.E.I.C., has recently severed his connection with the Michigan Avenue Holding Company to become engineer and general manager of the Oakwood Construction Company, Limited, a new Canadian corporation which has been formed to undertake construction of municipal work. Office will be opened shortly by the Oakwood Construction Company, Limited, at Windsor, Ont.

In his new office, incorporated with those of the George A. Johnson Company, consulting engineers, Colonel Watson in addition to serving his personal clientele, will collaborate on the engineering work of the Johnson Company, which includes surveys, reports, designs and supervision of construction of water works, water purification plants, sewerage systems, sewage disposal plants, refuse disposal stations, power developments and numerous other branches of civil, electrical and mechanical engineering.

Colonel George L. Watson, A.M.E.I.C., has removed his office from 16 West 41st Street to 150 Nassau Street, New York City, at which latter address he will continue his consulting engineering practice. Colonel Watson's experience covers a wide field in mining, tunnel, bridge, harbour improvement, pipe line and sewerage work in the United States; and extensive diversified experience in connection with the engineering corps of the British and American Armies in Europe during the World War. He is a member of the Board of Consulting Engineers to the New York State Bridge and Tunnel Commission and the New Jersey Interstate Bridge and Tunnel Commission.

F. H. Palmer, A.M.E.I.C., Junior Trade Commissioner, Department of Trade and Commerce, Commercial Intelligence Branch, has written an article on "Export Credit Schemes" which appears in the March issue of the Commercial Intelligence Journal, published by the Department of Trade and Commerce, Ottawa. This article deals with the history of export credit schemes, divided into three parts: the period up to the International Financial Conference at Brussels in 1920, the Conference itself, where a definite international scheme was adopted for consideration by the various states, and the post-conference period with the consequent development of the adopted international scheme of credits. Mr. Palmer left Ottawa on the 12th of March to tour British Columbia and the Prairie Provinces, going through to Victoria and visiting the various centres in these Provinces on his return trip.

George Hogarth, M.E.I.C., at the recent convention of the Association of Ontario Land Surveyors was elected president of the Association. Mr. Hogarth is a native of Ontario, having been born and educated in Toronto, and has elected to remain in his native province. He graduated from the University of Toronto in 1909, and after a short period of experience in railway work joined the staff of the Ontario Department of Public Works being assistant engineer from 1910 to 1916. During this period, Mr. Hogarth was interested in a number of important undertaking of the Department, including the Magnetawan Lock, the Winnipeg River Bridge, etc. His work was recognized by promotion to the office of chief engineer of the Department of Public Highways of the province of Ontario, which position he now holds. The notable work of Ontario in construction and maintenance of good roads is too well known to need emphasis. Mr. Hogarth has been a strong supporter of the Good Roads movement, in co-operation with W. A. McLean, M.E.I.C., deputy minister of highways for the province. Mr. Hogarth has been a member of *The Engineering Institute* when he joined as a Junior member, being transferred to Associate Member in 1913, and to Member in 1918.

Energetic Coast Councillor

Major George A. Walkem, M.E.I.C., who has recently been elected Councillor, has been an active member of *The Institute* since 1906 when he began a strenuous record of *Institute* service on his election as Associate Member. Major Walkem was born in King-

GEO. HOGARTH, M.E.I.C.
President of Association of Ontario Land Surveyors

GEO. A. WALKEM, M.E.I.C.
Member of Council

ston, Ontario, in 1872, and received his technical training at McGill University, from which he graduated in Mechanical Engincering in 1896.

Shortly after graduation he followed Horace Greeley's advice, and accepted a position with the B.C. Electric Railway Co., at Vancouver, in connection with the construction and installation of trackage. Following two years of private practice as consulting mechanical engineer Major Walkem was appointed general manager of the Vancouver Engineering Works with which company he remained from 1900 to 1906 when he became managing director of the Vancouver Machinery Depot Ltd. During the war Major Walkem saw active service in Egypt and Palestine with the Royal Engineers, when he was in charge of construction of all new stations, yards, etc. He has been active in support of all movements in British Columbia for the welfare of the engineering profession and was one of the original promotors of the Act incorporating the Association of Professional Engineers of British Columbia of which he is a Councillor. In addition to these many activities Major Walkem is interested in the civic life of Vancouver, being a director of the Vancouver Exhibition Association, the Vancouver General Hospital, and the Children's Aid Society of Vancouver. As a man and an engineer Major Walkem is one of the most popular on the Coast.

BRANCH NEWS

Vancouver Branch

F. H. Buchan, A.M.E.I.C., Secretary-Treasurer.

For several years, the British Columbia members of *The Institute* have been anxious to extend the courtesy of a Western Professional Meeting to their Eastern brethren. We have all felt that the natural charm of our beautiful province, together with its obvious importance in the engineering field, lend especial interest to such an undertaking. During the past two months, desire has been translated into action, and the Vancouver and Victoria Executive Committees have been conferring, with the object of making arrangements to hold a Western Professional Meeting during the coming summer.

At the general meeting of the Vancouver Branch, on the 16th March, Mr. Brakenridge was able to announce that the hearty co-operation of the Victoria Branch was assured, and that it had been provisionally decided to hold the meeting in Vancouver, on the 16th and 17th of June, if the Canadian Good Roads Congress, which is scheduled to meet in Victoria on the 13th to 16th June inclusive, can be arranged for the 12th to 15th instead. Failing this, *The Institute* meeting might be held in Victoria on the 16th and Vancouver on the 17th June.

Mr. Brakenridge's announcement was received with considerable pleasure and a resolution endorsing the action of the Executive Committee was carried unanimously. Steps have now been taken to obtain the sanction of the Council, and it is hoped that British Columbia may have the honour of issuing the invitation in the near future.

A general meeting of the Vancouver Branch was held in the Board of Trade Auditorium on Thursday, 16th March at 8.15 p.m. About fifty members were present, the chair being occupied by Mr. Brakenridge.

Several important matters of business were discussed, among which was the proposal to hold a Western Professional Meeting, as reported elsewhere in this branch news.

To foster the town planning movement in British Columbia, a special committee consisting of C. Brakenridge, M.E.I.C., W. H. Powell, M.E.I.C., and W. B. Young, A.M.E.I.C., was appointed, with power to add to their number.

Following the chairman's announcement that the Executive Committee held the opinion that the Branch could carry on without the collection of Branch dues a resolution was passed unanimously, confirming the action of the Executive.

A very interesting lecture, illustrated with a large number of lantern slides was given by William Smaill, B.A.Sc., M.E.I.C., on the "Construction of the Greater Winnipeg Water District Aqueduct. The difficulties encountered in the work, due to the muskeg and the numerous river crossings were very clearly demonstrated and the ensuing discussion kept Mr. Smaill quite busy answering the numerous questions of his interested audience. He was accorded a very hearty vote of thanks.

British Columbia Provincial Division

In the Branch News column of the March issue of *The Journal*, there was outlined the problem confronting the engineering profession in British Columbia, which has arisen out of the numerous organizations requiring the collection of annual dues. A measure of relief was realized in the decision of the general meeting of engineers held on January 7th last, to abandon the British Columbia Technical Association, even at the sacrifice of certain highly desirable functions, which that body was able to perform when the occasion required. To those members of the profession who are in close touch with the general situation, it has become increasingly apparent, that it would be most undesirable for the Association of Professional Engineers to dissipate its energies over too wide a field. Rather, it should confine its duties more particularly to the administration of the Professional Engineers' Act, for which purpose it was created. Nevertheless, the urgent need of a substitute for the B.C. Technical Association has been finding expression in various attempts to form new bodies, as for instance, the applications for chapters of the Association of Professional Engineers. Apart from the more vital aspects of these movements, further complications in the financial problem are threatened thereby; and it has become obvious that some solution must be provided in the near future to meet this dilemna.

The first condition to be satisfied, is the provision of a body which would be common to the whole of British Columbia, and which could act in conjunction with the Association of Professional Engineers, relieving that body of professional duties extraneous to the administra-

tion of the act. The second condition is that it must not depend for its existence on further levies of fees. The third point is that it should have branches empowered to deal with local problems not affecting the general welfare of engineers in the province. The last-named feature is of considerable importance, because it has evidently been felt in certain localities that the main body of the Association of Professional Engineers in Vancouver, may not be in sympathy with the local points of view in some of these questions, resulting in unfair decisions, either through lack of adequate representation on the Council or complete misunderstanding of local conditions.

Having appraised the situation in the manner just outlined, it became very apparent to the Executive Committee of the Vancouver Branch, that *The Institute* could provide a ready-made channel for finding these manifestations of energy in a direction highly advantageous to everyone concerned. The solution was simply the reorganization of the British Columbia Provincial Division. This body could act as a Provincial Headquarters, with branches at strategic points, empowered to deal with local affairs, and represented on the executive committee of the Provincial Division as provided in Section 60 of *The Institute* By-laws. Branches are already established in Vancouver and Victoria; and it would be a comparatively easy matter to create others wherever the situation might demand. The B.C. Division has been authorized by the Council; and, as can be readily seen on page 36 of the 1922 "Charter, By-Laws, etc.", is merely awaiting the election of the officers and members of its executive committee. Thus we have ready-made machinery for meeting conditions *one* and *three* in an ideal manner. The question of fees is unimportant, it being confidently believed that no serious outlay of funds will be entailed, either in the reorganization or maintenance of the Provincial Division. When it is realized that behind *The Institute* activities in British Columbia, is the influence and support of nearly five thousand members throughout Canada, among whom are most of the leading figures in the engineering profession of the Dominion, there can be no room for doubt that the plan of the Vancouver Executive will be a success if carried through, and that not only will *The Institute* be a powerful champion of the British Columbia engineer, but it will materially add to its own strength and prestige in Canadian national life.

In order to expedite matters, the Vancouver Executive Committee appointed a sub-committee of three, at a recent meeting to inquire into the subject of a Provincial Division and report to the next meeting of the Executive. Following this, the matter will be formally laid before a general meeting, when it is hoped that authority will be granted to proceed with the undertaking, as outlined.

Branch Library

Members of *The Institute* will be interested in knowing that steps have been taken to improve the library at 930 Birks Building. On 25th January last, a meeting of secretaries of the various professional bodies using these joint quarters was held, with the object of deciding on some plan which could be recommended to their respective executives and which would have the effect of co-ordinating effort, to the lasting benefit of the joint library scheme.

At present, the bulk of the books and periodicals in the library are the property of, or on loan to *The Institute*. one of the recommendations submitted, required that the ownership and custodianship of books be plainly marked; and in the case of loaned books, that the name of the private owner, and the society having the custodianship of each book, be recorded. Then in the event of any society wishing to withdraw, it would be possible for that body to take possession of its own books and remove them as soon as desired.

A joint Library Committee was recommended which would be composed of one delegate from each of the organizations participating in the scheme, and which would have complete supervision of the library and all matter pertaining to it. By this means it was believed that proper co-operation could be secured, while still preserving the right of individual ownership, and the identity of each society.

The Association of Professional Engineers has appointed J. Muirhead, M.E.I.C., as its delegate. The Vancouver Branch of *The Institute* made an appointment, but the delegate tendered his regrets, so that a further appointment will have to be made at the next meeting of the Executive Committee.

It is confidently believed that a very noticeable improvement in the usefulness and scope of the library will be experienced when the Joint Committee takes over its duties.

The Registrar of the Association of Professional Engineers of British Columbia has announced that the following members of the E.I.C. were admitted to membership in his Association on the 18th February, 1922: Wm. McGie Young, M.E.I.C., consulting engineer, Standard Bank Bldg., Vancouver, B.C.; J. P. Mackenzie, A.M.E.I.C., Supt. Loomis, McFee, Henry and Macdonald, contractors, Vancouver, B.C.; F. A. Devereux, A.M.E.I.C., Box 306, Victoria, B.C.

Calgary Branch

J. A. Spreckley, A.M.E.I.C., Secretary-Treasurer.

Floyd K. Beach, A.M.E.I.C., Branch News-Editor.

On February 24th, G. P. F. Boese, A.M.E.I.C., read a paper prepared by H. B. Muckleston, M.E.I.C., on "Actuarial factors in the design of Irrigation Structures". This paper was previously read before the Lethbridge Branch and appears in another section of *The Journal*. It provoked considerable discussion among the membership present. On the same occasion A. S. Dawson, M.E.I.C., gave some notes on "Actuarial Factors governing the use of creosoted timber in Irrigation Structures". Mr. Dawson intimated that the C.P.R. Natural Resources are starting investigations into the comparative life of treated and untreated timber in irrigation structures and when comparative data becomes available he will present them to *The Institute* through the Branch.

Annual Meeting

The annual meeting and election of officers was held following a luncheon at the Board of Trade on March 11th. The retiring chairman, B. L. Thorne, M.E.I.C., called for reports from the various committees. Among the recommendations may be mentioned the following as pertinent to the successful operation of the Branch.

R. S. Trowsdale, A.M.E.I.C., Chairman of the Mmembership Committee reported that it was felt by the committee that its duties should be shared by the whole Branch membership. Each individual member should make known the eligible persons the manner in which membership may be attained and should see that prospective members secure application blanks. The Committee as such should not be continued, and in its place there should be an active committee to secure attendance at meetings by reminding the membership on the day of meeting. It was felt that a higher percentage of attendance would do more for the Branch than larger membership.

G. W. Craig, M.E.I.C., Chairman of the Programme Committee pointed out that during the 15 months since the last general meeting, there have been seventeen meetings as against seven in the previous 12 months. He recommended the continuance of the Committee. Reports of other committees were heard, but as they brought up no matters of general interest to *The Institute*, they are not here repeated.

Arthur L. Ford, M.E.I.C., retiring Secretary-Treasurer, submitted a report bringing conditions of the Branch up to date as compared with the report at the end of the calendar year. He showed that the finances are in a sound condition and that the funds of the Branch now stand at about a thousand dollars. Revenue during the 15 months amounted in approximate figures as follows:—

Rebates from parent *Institute* and dues of affiliates	$265.00
Interest on bonds and savings	47.00
Branch news	81.50

Among his recommendations was the proposal that the Programme Committee arrange for more papers, even if brief ones, from the younger members. His other recommendations were very good, but being matters of internal economy are not repeated here.

A canvas of votes for officers for the ensuing year showed that a much larger vote than usual was cast, probably due to the fact that the new by-laws require at least two names for each of the executive committee and a real election rather than an acclamation resulted.

Officers for the year are:—

Chairman........P. J. Jennings, M.E.I.C.
Secretary.........J. A. Spreckley, A.M.E.I.C.
Treasurer.........G. P. F. Boese, A.M.E.I.C.

Ex officio:...... V. Meek, A.M.E.I.C., F. E. Emery, A.M.E.I.C., F. K. Beach, A.M.E.I.C. B. L. Thorne, M.E.I.C., P. Turner Bone, M.E.I.C. (Councillor)......G. W. Craig, M.E.I.C.

Following the announcement of election results from the scrutineers, P. J. Jennings, M.E.I.C., took the chair and addressed the meeting as follows:—

Chairman's Address

Before proceeding with any further business I would like to take a few minutes to express my thanks for the honour you have conferred upon me in electing me to the position of Chairman for the enduing year. I need hardly say that I highly appreciate the honour and shall endeavour to carry out the duties of the office to the best of my ability. I fully recognize that the standard which has been set by those very capable engineers who have preceded me has been a very high one, but with the support of the Executive Committee and the members of the Branch, I feel confident in predicting another successful year.

We have now 101 members in the Calgary Branch, made up, as follows:—

Members	22
Associate Members	59
Associates	2
Juniors	6
Students	5
Affiliates	7
	101

It is hoped during the coming year to considerably increase this membership and particularly in the Associate and Student class.

Out of a membership of 101 there should be no difficulty in obtaining at least two papers per month during the coming year—excluding the summer period. I know there is a large number of members who have information which would be useful to other members of **The Institute**, and I make a personal appeal to you individually to prepare a paper for the coming fall or winter session. It is not necessary for it to be a very long paper, so long as it contains some useful information, and we all have some information which could be passed on with advantage and be of benefit to us and **The Institute** generally. It is only by such means that this or any technical society can be a success, and I know you are all anxious that this Branch shall continue to prosper and be of value and service to us all. My appeal is, therefore, to you all to make a special effort during the coming year to help **The Institute** along.

Suggestions for Improving the Branch.

I should be pleased to receive any suggestions that may from time to time occur to members with a view to improving the Branch, of stirring up interest in our meetings, or of methods whereby we can improve our society and benefit ourselves. Although we are not an institution formed for the purpose of meeting for social intercourse in the true sense of the words — yet there is no reason for restricting ourselves at all our meetings to entirely technical subjects, and some little variety might possibly be introduced from time to time.

The Outlook for the Engineer.

I wish I could induce someone to write a paper on this subject, I feel sure it would be interesting and it is certainly a subject upon which much could be said. During the past year you have had an opportunity of discussing a report which was submitted on "Classification and Remuneration", and although a great deal of thought and time has been spent by various committees of engineers throughout the Dominion, we have not yet achieved a great deal. I do think, however, that some good ground work has been done and when the time arrives for taking some definite action the information will be available and useful. Our past-president informed us last year, informally, that before we could expect any general betterment in the way of remuneration, we must first raise our standard of ethics. I have not the time now, nor is this the occasion, upon which to discuss this question but I merely wish to mention it in passing with the hope that it may lead to some discussion at a forthcoming meeting.

The engineer constitutes the basis of all industrial progress throughout the world and no matter what branch of the industry is considered the engineer is the pioneer and prime mover. The inception, design, construction and subsequent successful operation of any work has to be carried out by the engineer and he is, always has been, and always will be an indispensable factor in the progress of civilization.

It is undoubtedly very satisfactory to the real engineer — the man who has his profession at heart and loves it for its own sake, to know that he is doing something which is really useful for the world's progress. Many of the members of this **Institute** here in Alberta can look with considerable pride upon the results which are now maturing and the progress which must rapidly follow as the result of their work and study. I refer particularly to the works which have been conceived, designed and constructed during the past ten or fifteen years in connection with irrigation development in this province. The same work is being undertaken to-day and many of those who are now engaged upon the preliminary studies and investigations of big development projects for the betterment of mankind will live to see the results of their labours. It may surprise many of you here to know that the engineers of this province have already been responsible for the design and construction of works for irrigation and water supply which have resulted in an expenditure of well over $35,000,000. But this is only a mere fraction of the amount that is likely to be expended in the further development of the water resources of the West during the next decade, the foundations for which are now being laid.

The engineer has not yet come into his own but the day is fast approaching when he will receive greater consideration for his work than he has in the past. You may think I am being carried away with over optimism as to our future, but I do not think so. Apart from his technical training the engineer is generally a good organizer and I may say that many of the thinking business men of to-day are looking to the engineer to straighten out some of the tangles into which many of the cities and towns of the West have got during the past few years. I, therefore, look for the appointment of engineer city managers in the very near future. Edmonton has already placed her affairs in the hands of an engineer and I am pleased to note good progress has already been made toward recovery.

The Natural Resources.

With the possibility in the near future of the turning over to the province of her natural resources, I am again optimistic as to the effect such a change will have upon the engineering profession. For instance, I look for larger expenditures on good road construction, reclamation by drainage of the thousands of acres of valuable swamp lands in the north, the development on a large scale of our tar sand deposits and a continued development in irrigation. Then there are the untold possibilities of development which will result if oil is found in commercial quantities.

In conclusion, gentlemen, I may say the prospects in Alberta for the engineer are such that there is no need for pessimism. There are at the present time very few engineers out of employment in Alberta, which in view of the present general condition of the money market is certainly gratifying.

I note from the current number of **The Journal** that of the many research problems suggested for the consideration of the Bureau of Standard and Research — no mention is made of one of the greatest problems facing the west at present time — I refer to concrete deterioration in alkali soils. **The Institute** has a splendid committee of Western engineers who are doing as much as can be done without having large funds at their disposal, but there is at present no real solution of the problem.

Edmonton Branch

R. H. Douglas, A.M.E.I.C., Secretary-Treasurer.

The regular monthly meeting of the Edmonton Branch was held in the Board of Trade Chambers on Thursday evening February 16th.

C. A. Robb, A.M.E.I.C., Chairman of the Edmonton Branch, presided.

Three fifteen-minute papers were given, each paper being followed by a fifteen-minute discussion.

Col. George McLeod, A.M.E.I.C., gave an interesting talk on Drainage Problems, dealing with the question of rainfall, disposal and the reclamation of lands. An explanation of the workings of the "Drainage Act" was also given. The Honourable J. L. Coté, A.M.E.I.C., led in the discussion following the paper, and A. McDonald, provincial drainage engineer, gave an description with costs of various drainage schemes that have been constructed and are being constructed in the province.

E. K. Hall, A.M.E.I.C., divisional engineer of the C.N.R., gave an instructive description of Edmonton to North Battleford and the Onoway to Whitecourt lines of the Canadian National Railway. Mr. Hall dealt with the constructive difficulties and also gave a comprehensive description of the country traversed, together with the commercial importance to Edmonton as a result of the construction of these lines.

Dr. K. A. Clark in his paper dealt with the possibilities of the bituminous sands of Northern Alberta. Dr. Clark pointed out that while the known deposits are of enormous extent, it is only those portions which are exposed along the sides of river valleys that can be excavated without encountering overburdens so excessive in thickness as to make the cost of development prohibitive. The valley outcrops, however, according to Dr. Clark, can provide ample material to satisfy all demands of the immediate future. Dr. Clark also stated that while the bitumen contained in the bituminous sand constitutes a direct source from which to prepare asphaltic products, such as those used for road construction purposes, this bitumen does not constitute a direct source from which to obtain satisfactory yields of gasoline, kerosene and lubricating oils by operations now practised in the petroleum industry. Dr. Clark's conclusions as a result of his studies were that owing to the distance of the deposits from centres of population their development depends upon the discovery of a suitable method of separating the bitumen from the sand. The bitumen free from sand should then be of sufficient value to stand the cost of transportation. Also the conversion of the bitumen into gasoline, kerosene and lubricating oils by means of distinctive distillation may prove a profitable method of developing the deposit.

In the discussion following, which was opened by Mr. Stansfield, much additional interesting information was brought out.

Winnipeg Branch

Geo. L. Guy, M.E.I.C., Secretary-Treasurer.
E. V. Eaton, A.M.E.I.C., Branch News Editor.

On the 2nd March 1922, at the regular meeting of the Branch, E. P. Fetherstonhaugh, M.E.I.C., in the chair, a paper was read by D. L. McLean, M.E.I.C., on the "Engineering Aspects of Drainage Problems".

Mr. McLean dealt with the whole question of drainage in a very able manner. He showed that over one seventh of the agricultural area of Manitoba was now within organized drainage districts and that there was approximately one million acres of land which could be made serviceable by proper drainage. The speaker emphasized the necessity for this work being done on a comprehensive basis and for the control to be under one head, instead of under the different municipalities. He discussed very fully the present laws in Manitoba with reference to drainage and a comparison was made between these laws and those of the other provinces.

Local News

The annual banquet of the Engineering Association of Manitoba University was held on the 3rd, March. A large number of the members of *The Institute* attended and in the speeches by members of the profession emphasis was laid on the desire of the practising engineers to assist the new graduates in every way. The banquet was a great success and enjoyed by all.

Municipal Engineering

At the regular meeting held on Thursday evening, 16th March, E. P. Fetherstonhaugh, M.E.I.C., in the chair, a series of papers was read upon the duties and responsibilities of municipal engineering. These papers were really a progress report of a special committee which had been appointed to take up the matter.

The subject was introduced by Professor J. N. Finlayson, M.E.I.C., and the following members of the Committee addressed the meeting:—W. E. Hobbs, A.M.E.I.C., W. Aldridge, A.M.E.I.C., J. W. Battershill, A.M.E.I.C.

Mr. Finlayson in his opening address mentioned the advantage of the Committee method of preparing papers. The present Committee had consisted of twelve members and a large number of meetings had been held. It had been decided to divide the subject under five headings:—

1. Duties and responsibilities of the municipal engineer.
2. Fundamental data.
3. Water works supply.
4. Sanitation.
5. Other utilities.

The speaker emphasized the necessity for more uniformity in design and construction of public works, particularly when looking forward to the possible future absorption of all outlying municipalities into one Greater Winnipeg. At the present time many points of difference are found among the adjacent municipalities which would entail either serious inconvenience or great expense to secure uniformity at some future date. There are also many other matters worthy of proper consideration; such as sewerage treatment and the question of the proper treatment of the water supply at some future date. A suggested organization chart for the municipal engineer's staff was shown, suitable for the average size of city and details were given of the various members on the staff and their particular duties. The failure on the part of many municipalities to appreciate the worth of the municipal engineer, upon whose duties the lives and welfare of the community actually depend, was emphasized by the speaker. He also made a strong plea for a more liberal education for the engineers and was emphatic in his statement that, while liberal studies were somewhat difficult to acquire unless they had been acquired in early life, many subjects of a highly specialized nature which were now dealt with by the technical colleges were quite assimilated by persons who had been properly grounded in the fundamentals of the science. This inclined him to believe that the curriculum of a technical college should include the more liberal arts and some of the highly specialized courses could quite well be dispensed with.

W. E. Hobbs, A.M.E.I.C., emphasized the necessity for study of the growth of the population and pointed out that unless this could be fairly accurately determined it was very difficult to economically design municipal works. He dwelt upon the necessity for designing these works of sufficient capacity to accommodate the possible increase in population during the life of the works. This necessitated the knowledge of the probable growth, which, while it was difficult to actually determine, could at the same time be fairly closely estimated for a maximum possible, which should be the basis for the construction of the various works. By proper town planning, not only would great economies be possible, but it would also be much easier definitely to determine the class of structures which would have the longest useful life. The figures given showed that 44% of the population of Manitoba was in Greater Winnipeg and with the improvements in conditions which would shortly take place the necessity for more economic distribution of the population and definitely defining of areas for commercial, manufacturing and residential purposes was emphasized.

Mr. Aldridge took up the subject of sanitation. The necessity for accurate rainfall data was explained and curves were shown for storm rain falls, the speaker explaining how these were derived and showing actual figures obtaining as against theoretical figures collected from different data available. The disposal of sewerage and the question of the pollution of the rivers and streams was dealt with and it was shown that the Red River with its minimum flow was sufficient to handle the sewerage for a population of half a million. Descriptions were given of actual sewer conditions and construction in and around Winnipeg, the most satisfactory construction having been found to be vitrified clay blocks with a natural cement mortar, the grades of the sewers being laid out to have a maximum flow of three feet per second. Refuse disposal was also dealt with. Costs and debenture issues were dealt with and the methods of charging assessment were explained.

Mr. Batterhill dealt with the water supply for municipalities. He emphasized the necessity for uniformity in design of the different water systems and the advantage of standardization in all fittings and fixtures. In the laying out of domestic water mains he pointed out that where both fire and domestic usages were required from the same mains the fire requirements set the standard and increased the cost from one third to one half above what would be required for purely domestic use. The Winnipeg standards for first class residential districts were given as 1800 Imperial gallons per minute at a 50 pounds pressure, and for the second class districts 1200 Imperial gallons per minute at 50 pounds pressure. The location of the water cocks, gate valves, hydrants and depth of mains was also discussed and the various types of meters and the necessity for standardization.

Sault Ste. Marie Branch

F. Theo. Gnaedinger, A.M.E.I.C., Secretary-Treasurer.

Heating Buildings

The January meeting of the Branch was held as usual on the last Thursday in the month. Papers were read on the subject of heating buildings and fuel testing. The discussion of these papers was very interesting as all the members had had some experience or other with the heating of buildings.

The selection of the most suitable and economical fuel for the purpose of heating the public schools of the city was the subject of a paper by L. H. Derrer, S.E.I.C Mr. Derrer acted in a consulting capacity to the School Board this year when they were making a choice of coal for their winter requirements. His paper described the different kinds of furnaces installed in the different schools, and the tests he carried out with two kinds of coal, pocohontas and bituminous. The tests were made to determine the amount of water evaporated per pound of coal under conditions as nearly uniform as possible in all cases, and under the A.S.M.E. code. The "equivalent evaporation per pound of coal from and at 212 degrees Fahrenheit" was computed for both coals in each furnace and used as a basis for comparison. The results of the tests were given and their use shown in the selection of the coal which was purchased by the School Board. It was estimated that a comparatively large sum was saved by buying coal on the basis of how much it cost to raise a pound of steam instead of merely on its price per ton.

The actual amount of heat required to heat a building and keep it comfortable was the subject of a paper by W. S. Wilson, A.M.E.I.C. On account of his absence from town the paper was read for him by the Secretary.

In his paper Mr. Wilson said that in Algoma it was necessary to heat buildings artificially from seven and one-half to nine months, according to the type of occupancy, and that both proper construction and adequate heating of buildings is required for comfort.

The principal source of loss of heat is by conduction This is measured in British Thermal Units, being the rate per square foot of wall surface per degree of difference of temperature between inside and outside air, per hour using a coefficient to represent the different types of construction. Many of these coefficients are published but care must be used in applying them. Coefficients for some types of construction are not available. Long vertical spaces like flues between inner and outer walls should be avoided.

Infiltration is an extremely important factor in all but the most carefully constructed buildings. Determination of air changes by infiltration is made by carbon dioxide determination which is difficult to use satisfactorily. The simplest way to stop leakage around windows is to use weatherstrip, preferably the recently developed forms of metal weatherstrip, which will cost $1.50 to $2.00 for material for windows of ordinary size and about $3.00 per window for labour for putting on. Some tests in the Bureau of Mines Building at Washington, D.C., quoted in the Journal Am. Soc. H. & V.E., a building of high class construction with windows weatherstripped and doors closed, showed for some rooms six to ten changes of air per hour. If that holds for a good building what must be the case in many of our poorly constructed buildings — and what a fuel waste at times when air is not needed for ventilation!

The heat regulation of the human body is an extremely interesting function and is marvellously efficient — a slight rise we call fever, and five or six degrees means a great danger; a slight lowering is injurious and a considerable lowering a fatal end. The body produces heat from oxidizing foods and it can absorb heat by radiation and to a slight extent by conduction from warm food in the alimentary canal. The body loses heat by radiation, by conduction (in warming food the above process from a thermal standpoint reversed is included), by warming air in the respiratory tract and by evaporation. Radiation and conduction can be controlled to a large extent by proper clothing. Evaporation, however, is dependent upon humidity and air movement to a large extent. The body can adapt itself to a great range of humidity if other factors are favourable. Movement of air accelerates evaporation and will to a varying extent offset the effects of humidity.

To produce proper humidity is difficult. Note the evaporation problem we have! Air from outside at a low temperature is introduced sometimes by design, sometimes by infiltration, into our homes or offices. Its natural moisture content is quite low at a low temperature. At seventy degrees its capacity for moisture is considerable, where can it find this moisture? Will it absorb all the moisture it can get from plants, utensils with water, and from the skin and lungs of the occupants? The active evaporation will produce a feeling of chilliness and the air will become a vehicle for the easy circulation of fine dust, carrying germs, which is inhaled and irritates the respiratory system. This is possibly the cause of much disease, probably of pneumonia.

A schedule showing the more general methods of heating was exhibited, and also a schedule showing characteristics of several buildings in Sault Ste. Marie, as well as types of heating plants and radiation installed, and fuel consumed per cubic foot of contents.

Industrial Plants and their Location

The February meeting was postponed until the second of March. A paper was read by F. Theo. Gnaedinger, A.M.E.I.C., on "Industrial Plants and Their Location".

A brief survey was made of the broad field of industrial engineering. Some of the principal features governing the selection of a site for a plant, both as to the locality and the actual site, were outlined and the necessary points to be studied were presented in the form of tables. The chief studies of the engineer engaged in planning, designing and constructing a plant were gone into and a scheme was given for covering the details of such work in a systematic way. In handling such a large subject in a paper it was necessary to deal with it only in general terms, and this was done. The use of flow-sheets as an aid to design was taken up and examples were given of the principal types: organization, process or operations

machine, and a combination type. The promoting, organizing and financing of an industry not infrequently come within the field of the larger professional engineering firms, but as these subjects were another phase of engineering they were considered outside the scope of the present paper. Blue-prints illustrating the different types of flow-sheets, and copies of the tables given in the body of the paper were passed around the meeting.

Among the items of business transacted at the meeting was a resolution which was passed expressing the Branch's approval of the aims and objects of the Honorary Advisory Council for Scientific and Industrial Research. The Secretary was instructed to forward a copy of the resolution to Council with an offer to render the Council such assistance as lay within the power of the Branch. At the same time he was to get in touch with the local M.P., and notify him that the Branch approved of the founding of the National Research Institute and requesting his views and assistance along these lines.

Sometime in the near future the Branch expects to have an address from Major Alex. C. Lewis, secretary of the Canadian Deep Waterways and Powers Association. The Sault is very interested in the objects of the Association and anticipates a large turnout at the projected meeting.

B. E. Barnhill, M.E.I.C., Vice-Chairman of the Branch, read a report of the Secretaries' Meeting held in Montreal at the time of the Annual Meeting. A Committee was appointed to draw up resolutions favourable to the proposals of the Montreal meeting, which will be formally passed at a later meeting of the Branch.

London Branch.

Geo. C. Wright, A.M.E.I.C., Secretary-Treasurer.
R. I. Olmsted, A.M.E.I.C., Branch News Editor.

A regular meeting of the Branch was held in the Council Chambers of the City of London on February 22nd, in which A. J. Grant, M.E.I.C., engineer in charge, Welland Ship Canal, gave a very interesting address illustrated with lantern slides, on the design and construction features of this work.

Mr. Grant in introducing the subject gave a brief resumé of the early canals along the St. Lawrence and across the Niagara Peninsula. The points covered by the address included:—Selection of the route, design, harbours, locks, bridges, construction features, and bearing the canal will have as a connecting link in the Great Lakes and St. Lawrence waterways scheme.

The lecture was highly appreciated by those present who were not engineers, as it gave them an idea of the size of the work undertaken and the difficulties which had to be overcone during construction.

Discussion of the address followed in which E. V. Buchanan, M.E.I.C., manager Public Utilities Commission, F. W. Farncombe, M.E.I.C., consulting engineer and J. R. Rostrom, A.M.E.I.C., took part.

The Chairman H.A. Brazier M.E.I.C. presided, and the meeting included several civic officials including Mayor Cameron Wilson as well as some thirty members.

A unanimous vote of thanks was tendered Mr. Grant for his excellent address.

Niagara Peninsula Branch

Rex. P. Johnson, A.M.E.I.C., Secretary-Treasurer.
G. R. Taylor, A.M.E.I.C., Branch News Editor.

A dinner meeting was held at the Welland Hotel, St. Catharines, on the 15th of March, with N. R. Gibson, M.E.I.C., the Branch Chairman, presiding. About 60 members and friends were present.

After the transaction of some Branch business the Chairman called on the speaker for the evening, H. C. Don Carlos, chief operating engineer for the Hydro-Electric Power Commission of Ontario, to give his paper on "The Operation and Maintenance of Generation and Transmission Systems".

Mr. Don Carlos stated that the H.E.P.C. were operating twelve generating systems and distributing 375,000 H.P. He outlined the office and field organizations and pointed out the need for flexibility, in order that emergencies might be rapidly and efficiently dealt with. He pointed out the great advantage of operating experience for any engineer engaged in the design and layout of electrical equipment, although it was difficult to induce designers to acquire practical operating experience. They had several examples on their own systems in which operators had suggested improvements in design that had been adopted by the manufacturers. One of the personal questions in operation not yet satisfactorily settled was the effect of the three 8-hour shift system on the health of the men. The shift system is, of course, necessary but it is supposed to be somewhat injurious to health and that problem has not yet been solved.

A detailed account of the Ontario Power Company's plant at Niagara Falls was given and some very interesting slides of ice conditions shown. The lecturer pointed out the great advantage to turbine maintenance caused by the utilization of electric welding. It is interesting to note that in 1917 the Ontario Power Company's Plant operated at ninety-seven per cent of its maximum capacity throughout the twelve months. This is probably a record for continuous operation.

The Niagara System exhibits some particularly interesting problems in operation and maintenance owing to the varying distances at which power is transmitted, and to the varying voltages at which it is delivered. The various methods of voltage and frequency regulation were outlined. The modern turbine governing systems greatly facilitate the frequency regulation. The lecturer praised the reliability of the modern transformer. At one time all transformers were returned to the manufacturers for repairs when necessary, but now the H.E.P.C. repair their own up to 5,000 K.V.A. capacity. Oil switches appear to give more serious trouble than any other type of equipment and need careful inspection at regular intervals and always after they have opened for short circuit, when the oil should be renewed.

The high voltage lightning arrester is of interest. The electrolytic type is on the whole satisfactory, though the maintenance cost is high. The oxide film type is being installed at most of the new stations. It is very satisfactory and is gradually replacing the older types. Most of the H.E.P.C. local distribution systems are tied in to other systems so that in the case of a breakdown in

a local station the load can be carried by other systems, thus ensuring an unusual reliability of service to consumers. The lecturer gave it as his opinion that in many cases sufficient attention was not given to the grounding of the structural steel in transformer stations and other buildings, and gave examples of serious accidents caused by this neglect. Transmission lines are designed to carry a coating of half an inch of ice with a 50 M.P.H. wind at 20 degrees below zero. It would be very unusual to find these three adverse conditions at the same time, and as a rule the transmission lines give little trouble and are readily handled by ordinary maintenance. It is not considered economical to construct a line capable of withstanding the worst conceivable weather, it being cheaper to handle the emergency when it occurs, which may only be once in several years. Tower construction is very satisfactory, tower failures being almost unknown. The careful and systematic testing of line insulators for leakage greatly helps to maintain the efficiency of the system. Some interesting slides showed the methods of testing as well as the method employed in changing insulators with the line alive, a method in considerable favour in the Southern States.

The lecturer briefly outlined the work of the metering and inspection department, the patrol gangs and the special repair gangs. He questioned the utility of the sky wire except in open tree-less country. All points of the H.E.P.C. system are connected up by private telephone wires which must be carefully protected from induction. In order to further overcome the possibility of a breakdown in communication, wireless telephone installations are being put in at the main stations.

Weekly load diagrams were shown for various municipalities. It is interesting to note that in the smaller municipalities where dwelling houses are the main consumers, the Tuesday load is invariably the highest. The speaker suggested this was caused by it being ironing day.

Discussion of the address followed in which N. R. Gibson, M.E.I.C., Chairman of the Board, J. R. Bond, A.M.E.I.C., Rex. P. Johnson, A.M.E.I.C., F. L. Code, S.E.I.C., F. W. Clark, A.M.E.I.C., and others took part.

Hamilton Branch

W. F. McLaren, M.E.I.C., Secretary-Treasurer.

Engineering Standardization

The Branch met at the Royal Connaught Hotel on February 16th, 1922, at 8.15 p.m., to hear an address on Engineering Standardization by R. J. Durley, M.E.I.C., Secretary of the Canadian Engineering Standards Association, Ottawa.

The speaker first gave a general outline of the work and noted the following branches or divisions:—

1. Dimensional standardization, having for its object economy and convenience arising from the interchangeability of parts.

2. Nomenclature and definitions.

3. Elimination of unnecessary types and sizes, thus economizing by reducing the amount of stock to be carried and simplifying production.

4. Fixing standards of performance and methods of testing, so that the methods of determining the capacity of a machine and its performance will be thoroughly understood both by purchaser and manufacturer.

5. Standardization of methods of construction and workmanship or operation; as exemplified in connection with standard bridge specifications, and the safety code work which is being so largely developed in the United States.

6. Standard specifications for materials. These are prepared with a view of unifying the requirements for quality and methods of testing, as well as reducing the number of unnecessary varieties of material called for or kept in stock.

It was pointed out that while these methods of standardization are very largely applied by individual firms in their own work, the object of an association like the C.E.S.A. is to extend this field of usefulness by obtaining, if possible, nation-wide agreement over the whole extent of an industry, the essentials being that the interests of both manufacturers and purchasers must be represented.. In the formation of committees for this purpose, the assistance of trade or industrial associations is often extremely valuable. It is also necessary that agreements reached by working committees should be submitted to a central organization in order to avoid the over-lapping of well meant individual efforts.

In most countries, engineering standardization is now carried out by voluntary organizations enjoying a measure of government support, but exceptions to this are France and Japan, where at present the engineering standardization work is done by Government Commissions.

Dr. Agnew, the Secretary of the American Engineering Standards Committee, has drawn up a memorandum which very clearly and concisely outlines the work. He brings out the following advantages which may be realized if standardization is carried out:—

1. Buyer and seller use the same language.
2. It promotes fairness.
3. It reduces costs of manufacture.
4. Lower prices are paid for materials.
5. It decreases litigation.
6. It eliminates indecision.
7. It decreases selling expenses.
8. Fewer lines are carried and these are of better quality.
9. It stimulates research.
10. It enables the results of research to be put to practical use.
11. It eliminates practices which are merely traditional, because when specifications are criticized, unnecessary features are exposed.
12. It bases competition on efficiency only.

The British have been pioneers in the work of standardization of this kind, the earliest example being of course the introduction of the Whitworth thread by Sir Joseph Whitworth. The British Engineering Standards Association was formed in 1901, and has now over 2,000 working members in its various committees. It has published over 150 reports, specifications, etc., and has

formed local committees in various parts of the world, such as China, the Argentine, etc., with a view of encouraging the use of British standards. The work of the B.E.S.A. received a great impetus during the war when the value of standardization was very impressively demonstrated by the rapid technical advances made owing to the pooling of information among manufacturers.

In the United States the work of engineering standardization dates back some twenty years, the first bodies interested in it having been the A.I.E.E. and the A.S.M.E. There are now over one hundred technical societies and bodies engaged in this work in the United States, and the American Engineering Standards Committee which was formed in 1918 as a central co-ordinating body, does not originate standards, but acts as a clearing house for those drawn up by the various technical associations.

The work carried on in the various countries of Europe was briefly outlined.

A brief outline was given of the work of the Canadian Engineering Standards Association, which, of course, has the close sympathy and support of *The Engineering Institute of Canada*. The C.E.S.A. work, like that of the British and Belgian Standards Associations, has so far dealt rather with standard specifications than with dimensional work and it would appear likely that in view of the close manufacturing relationship between Canada and the United States, work of the latter type will be largely influenced by American practice.

The C.E.S.A. was formed in 1919 with the object of carrying out in Canada, for the benefit of Canadian industry, works similar to that done in England by the British Engineering Standards Association, which has proved of such great industrial value. The Canadian Engineering Standards Association is not a Government institution, although it is recognized by the Canadian Government. The members of the Association, who serve on its committees gratuitously, are qualified by their technical and industrial standing to represent the interests of manufacturers, engineers and users, and members of the Main Committee are nominated by such bodies as the Canadian Manufacturers' Association, the Canadian Institute of Mining and Metallurgy, *The Engineering Institute of Canada*, the engineering schools of the universities, the railway services, important industrial firms, and the great purchasing departments of the Canadian Government.

The Association has been incorporated by Dominion charter, and is financed by contributions from the technical and industrial societies interested, as well as from individual firms, and these are supplemented by a grant from the Dominion Government.

When a request or suggestion is received from some responsible firm or person to the effect that the formulation or revision of a C.E.S.A. Standard is desirable, the Association confers with the various interests likely to be affected by the establishment of such a standard, and arranges for the organization of a committee to consider the matter. This committee includes representatives of the producers and users of the standard in question together with such technical advisers as may be considered desirable. The selection of such a working committee is accomplished through the proper sectional committee of the Association, under the chairmanship of a member of the Association. If the committee so formed recommends the adoption or modification of a standard, its findings are reviewed by the Association, the Main Committee of which must be thoroughly satisfied that full consideration has been given to the subject before it authorizes publication by the Association.

So far five publications have been issued and two more are under discussion.

The address was closed by throwing on the screen slides showing samples of the standards sheets adopted by various countries.

The chair was occupied by E. H. Darling, M.E.I.C., who threw the meeting open for discussion, which was participated in by Messrs. Bertram, Hart, Palmer, Williams and Martin, and closed with a hearty vote of thanks to Mr. Durley for his able address. The attendance was about 40, and it was announced that there would be a joint meeting with the A.I.E.E. on 24th March, and possibly there would be another meeting arranged before that date.

Power House Construction

A meeting was held in the Royal Connaught Hotel, 3rd March 1922, to hear F. H. Farmer, M.E.I.C., engineer for the Canadian Westinghouse Co., on "Construction Work".

Mr. Farmer said in part, as follows:—This paper deals with construction work incidental to installation of electrical equipment in power houses. There is much to recommend that the installation of such equipment should be handled by the manufacturer, especially in the larger sizes of machinery, since this places on the manufacturer the responsibility of completing the work and placing in operation, and ensures that the apparatus will be installed to the manufacturer's satisfaction. It is the usual practice to include in the contract the installation and subsequent operation of generators for a specified period by the manufacturer, and usually in the case of large transformers. There is a tendency for purchasers to install switching equipment by their own staff.

One difficulty which is frequently encountered is the late date at which access to the building is available, which usually results in undue pressure being placed upon those engaged in construction work to rush completion of apparatus. This often calls for premature commencement of installation operations under unfavourable conditions.

The history of the electrical industry is marked by the every increasing size of units. In the space of 15 years, hydro electric generators have increased from 7500 K.V.A. to 45,000 K.V.A. The bearing of this on installation work is marked, much of the work which was formerly completed in the manufacturer's factory, being now of necessity carried out on the site on account of shipping limitations. The handling of apparatus at the site should be fully covered by contract, and careful enquiry must be made into the facilities for handling from the cars to the site.

In Canada the problem usually met is to couple up a generator to a turbine which has already been placed. No hard and fast rules are to be laid down for lining up vertical and horizontal machines, the method being decided by the engineer in charge of the work. On vertical machines the line up is not complicated by any consideration of sag in the shaft. It is essential however that the guide bearings should line up very accurately with the turbine shaft. The vertical alignment of guide bearings is dependent on the levelling of the bedplate and it is therefore necessary to secure the greatest possible accuracy in setting the bedplate in the first case.

The use of a spirit level has limitations for such work on account of the fact that it only determines the level of a short portion of a machined face, and the use of a long straight edge is open to the objection that it will have a certain amount of sag. The most satisfactory method appears to be the use of a good engineer's level with a suitable target, preferably with a hairline subject to micrometer adjustment.

After assembling the guide bearings a check will be made for vertical alignment. This can be best carried out by using a heavy plumb bob whose vibrations are damped by immersion in oil. A fine piano wire strained close to its elastic limit is recommended to suspend the plumb bob. This will be adjusted so as to be central with top of the upper guide bearing, and measurements may be taken to the inner surface of the bearings at different points by means of a light pin gauge. After the shaft has been inserted a final check between coupling faces is made by means of feelers and the gap may be checked within ".001.

In the case of a horizontal shaft machine there will be a sag in both the turbine shaft and the generator shaft, with the result that if the four bearings are set at the same elevation the coupling faces will be close at the bottom and wide at the top. It will be necessary to raise the outboard bearing of the generator in order that the coupling faces may become parallel in order that no strains be introduced between the shafts and couplings. The rectangular form of the bedplate of horizontal machines is very liable to assume distortion due to the holding down bolts and care is necessary to see that it does not become twisted or distorted.

The placing of the shaft in the rotor is usually carried out as a field operation. This will be done either by pressing in cold, or by heating the hub and shrinking on to the shaft where the hub is solid. Where the hub is slotted it is drawn into the shaft by means of shrink rings or shrink keys. The fitting of pole pieces requires considerable care. Each pole piece is fitted to its own slot and the key paired and driven. They are then removed and scraped to a good fit before they are finally driven home, and it is essential that they should be driven right to the limit. Where it is necessary to carry out complete winding at the site, it is very desirable that the power-house should be in good condition as regards freedom from moisture and exposure to weather.

After completion and before placing in operation, a thorough dryout of the machine is essential. This will usually be done by running the machine at low speed with winding short circuited, and adjusting current to a suitable point. The ventilation should be restricted so as to allow of a fairly high temperature in the winding. Temperatures will be recorded and insulation resistances taken periodically. Drying will be continued until the insulation resistance reaches a steady value after which the machine is ready for voltage test and commercial operation.

In the handling of transformers the essential feature is to ensure that the transformer cores are not subjected to exposure to atmosphere any more than absolutely necessary. The usual method is to ship transformers in oil, either in their own tanks if size permits, or otherwise in suitable shipping tanks to be transferred to their own tanks at their destination. The oil should be drawn in under vacuum in the latter case to ensure that there will be no air pockets at any part of the winding. If for any reason the cores are not shipped immersed in oil, a complete dryout of the transformer becomes necessary, and this is preferably carried out by subjecting the tank containing core to vacuum and heating by means of applying voltage to the primary with the secondary winding short circuited. Particular attention will be paid to the cooling coils to ensure that there are no leaks which might allow water to escape into the oil

The paper was illustrated by means of a series of slides showing various transportation problems, methods of handling apparatus during erection, and several special conditions. In conclusion a number of pictures were shown illustrating the erection of 45,000 K.V.A. Westinghouse generators at Queenston Power house.

Mr. Darling was Chairman, and the attendance about 100. Mr. Hart moved a hearty vote of thanks which was carried with applause.

Toronto Branch

F. B. Goedike, M.E.I.C., Secretary-Treasurer.
C. R. Young, M.E.I.C., Branch News Editor.

At the meeting held on March 2, H. A. Goldman, A.M.E.I.C., presented a most thoughtful paper on the rise and fall of prices comprising a study of price movements during the past 100 years, with particular reference to the effect of the supply of goods and gold. This paper was published in advance proof form in *The Engineering Journal* for March. An animated discussion followed Mr. Goldman's paper in which the following members took part: Professor Peter Gillespie, M.E.I.C., R. O. Wynne-Roberts, M.E.I.C., G. W. Winckler, M.E.I.C., Frank Barber, M.E.I.C., and others. Announcement was made at this meeting that C. H. Rust, M.E.I.C., had presented a large nember of bound volumes of "Engineering Record" to the Branch. In a formal motion the thanks of the Branch were tendered to Mr. Rust for his exceedingly valuable gift.

Law and Engineering

A valuable presentation of the legal contacts of engineering was made at the meeting of March 9 by Alfred Bicknell of the legal firm of Bain, Bicknell, MacDonell and Gordon who spoke on "Some Legal aspects

of Engineering Problems". Mr. Bicknell, in describing the nature of law, deplored the fact that no codification had yet been made of the law of engineering and construction in Canada. On account of the necessity of hunting up many amendments a clear understanding of the law was difficult except by a trained lawyer. The speaker outlined carefully the essentials of a valid contract, laying emphasis on the fact that there must be a clear offer and a clear acceptance. Wherever new terms are introduced in the proposal, or if an acceptance is conditional, there is no binding contract, unless both parties clearly agree to the changes that have been made. The tender, said the speaker, may be withdrawn any time before acceptance, whether it be accompanied by a deposit check or not. If acceptance is required in a definite or prescribed manner, there is no contract unless it be so carried out. Mr. Bicknell pointed out the danger attending the making of contracts with municipal corporations which require the authority of by-laws to undertake certain enterprises. If such by-law has not been passed the contractor is not able to obtain compensation for his work. In order to take legal action against the Dominion or Provincial Governments it is necessary first to obtain a fiat of the Minister of Justice or of the Attorney General, respectively and then proceed by petition of right. Mr. Bicknell pointed out that even governments have no authority to modify the terms of a definite contract, citing the case of the invalid ordering of certain extras on a wharf contract by a Minister of Public Works in the Dominion Government. As the contract definitely stated that extras would only be allowed on the written order of the engineer-in-charge, the contractor was unable torec over for the extras.

Following the address a vigorous discussion occurred. J. B. Carswell, A.M.E.I.C., pointed out objectionable features of many contracts from the point of view of the contractor. He drew attention to the standard contract form prepared by the Canadian Association of Building and Construction Industries and urged that action be taken on this form by the Council of *The Institute* to whom it had been submitted a year ago. J. M. Oxley, M.E.I.C., objected to plans being classed as goods under the law and asked also what the powers of a municipal commission were in retaining expert assistance by the mere authority of the executive head of the Commission. E. M. Proctor, A.M.E.I.C., expressed the view that where the mayor of a municipality secures the employment of an expert without the authority of a by-law he should be held liable on the ground of breach of warrant of authority. In speaking of the binding nature of verbal agreements, Mr. Proctor cited a case where a contractor had built a bridge on the verbal instructions of the municipal council without definite by-law or written resolution. Although the validity of this agreement was questioned, the contractor was able to obtain payment for his work by appealing to the courts. Wm. Storrie, M.E.I.C., asked if it were necessary to wait until a nuisance had actually been created before applying for an injunction to restrict the parties contemplating such objectional act.

A. T. C. McMaster, M.E.I.C., A. Ross Robertson, A.M.E.I.C., T. L. Crossley, A.M.E.I.C., R. J. Fuller, A.M.E.I.C., H. A. Goldman, A.M.E.I.C., W. J. Smither, A.M.E.I.C., G. G. Powell, M.E.I.C., and C. R. Young, M.E.I.C., also took part in the discussion.

Mr. Bicknell , in commenting on the various observations made on the address, stated that acceptance of an offer might properly be made by telegram but a confirmation was most desirable to avoid possible errors in transmission. The status of the architect or engineer on the work which had been questioned by some was definitely outlined in the contract, said the speaker, In some respects the engineer was an impartial arbitrator between the two parties, and in others he was an agent of one of the parties. The authority of a municipal commission to enter into contracts should be based upon this status as a trading corporation. Mr. Bicknell was of the opinion that a motion adopted in Council, with a seal attached was in effect, a by-law. He stated that it was not necessary to wait until a real nuisance had been created before applying for an injunction. If it could be established that a contemplated act would undoubtedly create a nuisance the injunction could be obtained beforehand.

At the executive meeting which preceded the programme for the evening the matter of securing advertising for *The Journal* was discussed by Mr. Maxwell representing headquarters of *The Institute*. It was decided to refer the matter to the incoming executive for consideration. In consideration of their services to the Branch the present Secretary and the immediate Past Secretary were each granted an honorarium of $100.

Annual Meeting

The meetings of the Branch for the present session were concluded on March 16 when the annual meeting was held. Reports of committees were received and discussed and the new officers were elected and installed.

Geo. T. Clark, M.E.I.C., Chairman of the Branch, in making his retiring address described briefly the progress that had been made by the Branch during the year. Financially some useful work has been done, including, amongst other things, the wiping out of an old obligation of $199 to the Engineers' Club for book-cases and work done in connection with the library. The sum of $125 had been advanced to the library committee for necessary improvements and an honorarium of $100 each had been voted to the present and the immediate past Secretaries. Mr. Clark warmly commended Willis Chipman, M.E.I.C., and Col. H. J. Lamb, M.E.I.C., for their indefatigable work in connection with engineering legislation.

F. B. Goedike, M.E.I.C., Secretary-Treasurer, reported a cash balance of $37.425 with an outstanding check of $125, thus giving a surplus of $249.25. Col. H. J. Lamb, M.E.I.C., Chairman of the Finance Committee, confirmed the report of the Secretary-Treasurer.

The Chairman of the Branch, in reporting for the membership committee, pointed out that a conisderable number of students who had applied for membership a year ago had not taken up their memberships and consequently the membership of the Branch now stands at about 450, although it had appeared that it was considerably greater than this.

C. R. Young, M.E.I.C., Chairman of the Publicity Committee, reported the extent of the efforts of the committee toward obtaining publicity for the activities of the Branch and the degree of success attained. J. M. Oxley, M.E.I.C., in discussing the report deplored the fact that the daily newspaper almost always neglect to give the names of the engineers connected with a piece of work that is being described.

T. D. Mylrea, A.M.E.I.C., Chairman of the Committee on Ethics, reported that not much progress had been made during the year, but expressed the view that the work should be continued.

J. M. Oxley, M.E.I.C., Chairman of the By-Laws Committee, outlined the work that had been done by that Committee in preparing the amendments which had been submitted to the membership for sanction by ballot. H. L. Seymour, A.M.E.I.C., Chairman of the Town Planning Committee, submitted a statement of the town planning activities in this part of the country as observed by the members of the Committee.

T. L. Crossley, A.M.E.I.C., Chairman of the Committee on Sociology, reported progress and pointed out some useful lines of activity which might be pursued in the future. R. O. Wynne-Roberts, M.E.I.C., Chairman of the Reception Committee, urged that every effort be made to assist the Committee in obtaining the correct addresses of members.

A. C. Oxley, A.M.E.I.C., Chairman of the Library Committee, stated that the $125 grant was being used to bring up to date the Proceedings of the American Railway Engineering Association and to purchase a number of valuable text-books which, in the opinion of the Committee, should be in the Library. G. G. Powell, M.E.I.C., in discussing the report urged that an appraisal of the books owned by the Branch be made with a view to a possible increase in insurance. Frank Barber, M.E.I.C., expressed the view that the insurance was not sufficient and that not enough money was being spent on the library. It was resolved to refer the matter of appraisal and the insurance to the new executive.

J. G. Jack, A.M.E.I.C., Chairman of the Committee on Employment, reported that there had been a lack of positions offered and so the Committee had not been able to do any useful work.

J. M. Oxley, M.E.I.C., reported that as special representative of the Branch on the Committee appointed to consider the Lightning Rod Act, he had carried out the duties assigned to him and the Act as now revised had been passed by the Legislature.

Votes of thanks were passed to Willis Chipman, M.E.I.C., and Col. H. J. Lamb, M.E.I.C., for their work in connection with legislation in Ontario and also to Geo. T. Clark, M.E.I.C., for his untiring efforts in promoting the welfare of the Branch during the past year. H. A. Goldman, A.M.E.I.C., and T.L. Crossley, A.M.E.I.C., who had been appointed auditors, reported to the meeting that the books of the Secretary-Treasurer had been examined and found correct.

The Nominating Committee, of which G. A. McCarthy, M.E.I.C., was chairman, acted as scrutineers, and reported that the following had been elected to office for the ensuing season: Chairman, Wm. Storrie, M.E.I.C.; Vice-Chairman, E. G. Hewson, M.E.I.C.; Secretary, Treasurer, F. B. Goedike, M.E.I.C.; Executive: R.C. Muir-M.E.I.C., N.D. Wildon, A.M.E.I.C., and W. A. Duff, M.E.I.C.

The retiring Chairman then turned over the meeting to the Chairman-elect, Wm. Storrie, M.E.I.C., who, in accepting office, regretted the fact that through the fortunes of the election the services of some valuable members of the executive would be lost for the coming year. He expressed the view that the position of Chairman of the Branch, at least, should be filled by acclamation and that certain advantages would accrue from the Branch electing an executive and the executive then electing the officers. F. B. Goedike, M.E.I.C., and W. A. Duff, M.E.I.C., of the new executive expressed their appreciation for the support given them by the members.

Students' Night

Encouraged by the success of their last meeting, the Students' Committee, E.I.C., held another Students' Night in Hart House on February 6th. Again the lecture room was filled with enthusiastic undergraduates and engineers evidencing the popularity of this unique event. The four papers presented by undergraduates were very carefully prepared and were extremely well delivered.

A. M. Reid, S.E.I.C., chairman of the Students' Committee, opened the meeting by announcing that he had become an adherent of the principle of decentralization or "passing the buck" so he was going to ask H. S. Weldon, S.E.I.C., to take the chair for the evening. Mr. Weldon and H. S. Clark, S.E.I.C., were responsible for the organization and advertizing of the meeting and to them goes the credit for the success of the gathering.

"Breaking Rock in Drifts and Tunnels" was the subject of the first paper given by J. Drybrough. Rock excavation was of interest to most branches of engineering, although only indirectly in some cases. It had been done since the dawn of history but the bulk of the progress had taken place since 1850. In Northern Ontario, the hammer drill is almost exclusively employed and gives efficient service. The types of rounds used in drifts are the wedge cut, diamond cut, draw cut, and burn cut. In larger tunnels the same cuts, but with slight modifications, are used.

In presenting the paper on "Primary Triangulation" H. G. Rose, D.L.S., made what might appear a dry subject decidedly interesting. Primary triangulation consists of a series of points on the earth's surface which form the vertices of triangles whose sides average over twenty miles in length. The purpose of such a triangulation is to give a control for topographical survey work. Figures are chosen with the triangles interlaced to give a check on the observed angles. The latter are adjusted by the method of least squares. In Canada up to the present, the triangulation is being used as a control for hydrographic survey work, Militia Department Topographical maps and for accurate mapping of some of the principle cities.

Mr. Weldon then called upon Prof. H. E. T. Haultain, M.E.I.C., who in a short talk laid great emphasis on the need for an "Engineering Spirit" among the members of the profession.

Speaking on Small Water Powers, T. S. Glover, Jr.E.I.C., drew attention to the large number of uses to which small water powers could be put, but caution and thorough preliminary investigation were necessary. As an example of the work of preliminary investigation, the speaker outlined his experiences in Northern Newfoundland, last summer, whilst engaged on work of this nature for Dr. Grenfell, of Labrador fame.

In commenting on Mr. Glover's paper, Dean Mitchell complimented him very highly on his ingenuity in surmounting difficulties due to lack of equipment. Professor Angus who assisted Mr. Glover in an advisory capacity, next pointed out the difficulty of developing small water powers at a reasonable cost per horsepower.

The fourth and last paper was read by R. A. H. Galbraith, Assoc.I.R.E., S.E.I.C., on the subject of "Radiotelegraphic Transmitters".

Mr. Galbraith outlined the principles and applications of the "spark" and "arc" types of transmitters, and made some reference to the "valve" type of transmitter. In this connection, he produced for inspection by the meeting, several different types of "power valves". It is regretted that lack of time precluded more than passing reference to the existence of a fourth type of transmitter, namely the "radio-frequency alternator".

Peterborough Branch

D. L. McLaren, A.M.E.I.C., Secretary.

The regular meeting of the Branch was held on February 23rd and was addressed by Thos. W. Gibson, deputy minister of mines for Ontario, and Dalman Neeley, secretary of the Mine Owners' Association of Ontario. These gentlemen impressed upon their audience the importance of the mining industry as a factor in the prosperity of the country, the potential value of the products of the mines of Ontario, and also that mining is a legitimate and necessary industry and not a gamble for stock brokers.

Mr. Neeley threw much light on the potentiality of the industry. "Mining is a basic and essential industry," he said. "If there was no mining we would be living in the stone age. Mining has been the mainspring of colonization of New Ontario," he declared. Less than one-fifth of Canada is suitable for agricultural; the other four-fifths must be devoted to lumbering, fur-trading and mining, and of these three, mining is the most important.

World history, he said, showed that on the heels of the miner inevitably came colonists, and primarily the credit for settling must be given to the men seeking precious metals. The speaker recalled the common teachings of not so long ago, now exploded, that New Ontario was a useless wilderness. Only those who are well acquainted with that country, he said, realize what the future holds for it.

In the growth of Timmins, the centre of the Porcupine mining district, the progress of the country is shown. Twelve years ago, where this town now stands was a trackless waste of rock and scrub. Last year the freight receipts of the railroads there was only exceeded by one town in Ontario. The town assessment is $2,225,000, last year's pay roll was $4,500,000. and bank clearings for 1921 totalled $7,000,000. an amount in excess of the total for any other town under 10,000 population in the Province.

Mr. Neeley defended the nickel companies, who, he said, had been unjustly criticized. The companies, during the war, never increased the price to the British Governments above their 1913 prices.

In concluding, he emphasized the fact that every business man in Old Ontario should be interested in the development of the Province's mineral resources, for, directly or indirectly, he was affected by their prosperity or poverty.

The deputy minister of mines for Ontario, Thos. W. Gibson, traced the development, of gold mining in Ontario from a small beginning up to its present large production. His address was illustrated with lantern slides and motion pictures.

Queenston Chippawa Development

The assembly room of the Chamber of Commerce proved to be entirely too small to accommodate the members who wished to hear an address on the Queenston Chippawa Power Development, by A. C. D. Blanchard, M.E.I.C., field engineer on the above development. There were about 125 present and about as many turned away. The meeting was open to the public.

Ottawa Branch

F. C. C. Lynch, Associate E.I.C., Secretary-Treasurer.

Meeting of C.I.M.M.

The 24th Annual Meeting of the Canadian Institute of Mining and Metallurgy was held in Ottawa from March 1st-4th.

The Institute very kindly extended a special invitation to the members of the Ottawa Branch of *The Engineering Institute* to attend Dr. Harvie's Address and the excursion to the mine of the Kingdon Mining and Slmeting Company at Galetta, which was much appreciated.

As many members of *The Engineering Institute* are also members of the Canadian Institute of Mining and Metallurgy a short synopsis of the Annual Meeting might be of interest.

The presidential address of Dr. Corless emphasized the importance of mining to civilization, and referred to Canada's pre-Cambrian area, only a portion of which had been scientifically prospected.

All the papers presented were of a high standard and several of them included motion pictures, such as the descriptions of the Hollinger and McIntyre gold mines. The paper presented by Prof. Haultain, on "Ball Mills," was illustrated by a moving picture taken by an ultra speed camera.

Of special interest was Dr. Adam Shortt's paper on the "Economic Relations of Canadian Gold Production," as also the subject of the "Relationships of the Mining Industry to the Canadian Railway Problem," in which Chas. Camsell, deputy minister of mines, pointed out the importance of mining in relation to the railways,

owing to the high proportion of the total railway tonnage contributed by the raw products of the mines, amounting in 1919 to over thirty-five per cent.

E. L. Bruce, presented a very interesting paper on the "Possibility of the Use of Seaplanes in Preliminary Prospecting and Geological Work," pointing out that from the air it is possible to tell various areas by their colour and by the general surface features that are characteristic of sections of country underlain by different types of rock.

Space will not permit of individual mention of the many other papers of equal merit.

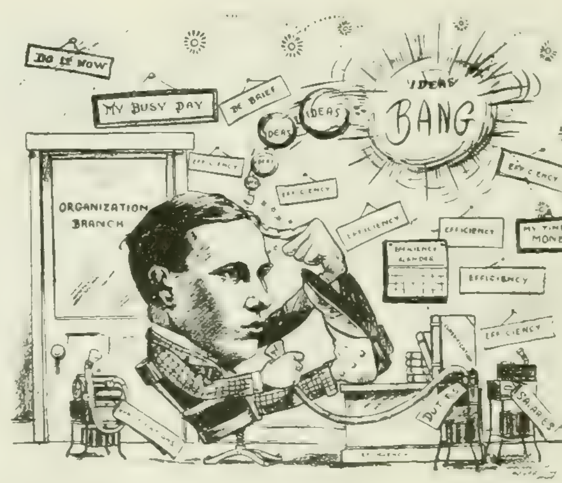
The excursions consisted of a visit to the refinery of the British America Nickel Corporation at Deschenes, Que., in which over a hundred members and visitors participated; and to the Kingdon Mining, Smelting & Manufacturing Co's mine and plant at Galetta, Ont.

Other trips were arranged in the vicinity, including those to the Royal Mint, Parliament buildings, and the Department of Mines testing plants as well as to some of the industrial plants in Hull.

Canadian Water-powers

Development of water-power and progress in construction upon Canadian rivers and streams are constantly making greater demands for hydrometric data. The growth of such studies during the past 17 years was the subject of a very interesting address by Sidney B. Johnson, M.E.I.C., senior assistant engineer of the Department of Public Works, at an evening meeting of the Ottawa Branch on February 23, held at the University Club. A very large number of interested listeners were present, and hearty appreciation of the address was shown. Mr. Johnson said that as a result of the investigations of the past fifteen years it was now possible to estimate closely the available power of practically all of the falls and rapids of any importance on the streams and rivers flowing into the Great Lakes and the St. Lawrence river, and on the latter itself. A discussion of the paper followed being taken part in by Messrs, S. G. Dawson, A.M.E.I.C., Reclamation Branch; D. W. McLachlan, M.E.I.C., Department of Railways and Canals; C. G. Cline, A.M. E.I.C., Dominion Water Power Branch; F. H. Peters, M.E.I.C., Department of the Interior; and D. W. Bell Dawson, M.E.I.C., Tidal Survey. A number of out-of-town visitors were in attendance, among them J. L. Busfield, A.M.E.I.C., Secretary of the Montreal Branch and member of the Walter J. Francis Company, consulting engineers, who made the trip specially to hear the paper; E. C. Goodspeed, M.E.I.C., St. John, N.B.; D. O. Lewis, M.E.I.C., Vancouver; and J. A. Jameson, M.E.I.C., Montreal. The Chairman of the Ottawa Branch. K. M. Cameron, M.E.I.C., presided.

Resourcefulness when put to the test is one of the qualifications of the successful engineer. Such was demonstrated at a luncheon of the Ottawa Branch on the 16th instant, when each of the past chairmen of the Branch was called upon to tell a story or spin a yarn. The plan developed an extremely enjoyable meeting, and the ten speakers, who were each given three minutes, competed for a prize offered by the present chairman K. M. Cameron. Of the past chairmen of the



C. V. PUTMAN — Always on the job.

Branch since 1909 only three were unable to attend, Messrs. W.J. Stewart (1910), M.E.I.C., S. J. Chapleau, M.E.I.C., (1912), and G. A. Mountain. M.E.I.C., (1914), The following were the speakers at the meeting and the years when they were in the executive position; C. R. Coutlee, M.E.I.C., 1909, A. A. Dion, M.E.I.C., 1911; R. F. Uniacke, M.E.I.C., 1913; A. St. Laurent, M.E.I.C., 1915; J. Murphy, M.E.I.C., 1916; A. Gray, M.E.I.C., 1917; G. Gordon Gale, M.E.I.C., 1918; R. de B. Corriveau, M.E.I.C., 1919; G. B. Dodge, M.E.I.C., 1920; and Commander C. P. Edwards, M.E.I.C., 1921. Each speaker had a good story to tell, and the honours being about even the chairman presented each with a prize, consisting of a homely clay pipe, tobacco, matches, etc. Each was also in turn adorned with a chaplet of laurel leaves.

C. R. Coutlee who was introduced by the chairman as an "esteemed" member, remarked amid laughter that it was the first time he knew he was run by steam. He told a good story of a surveyor who was caught with plans in a court case that had been wrongly drawn, but who claimed that his ground was all right. A. A. Dion's story had to do with a motoring experience in which he actually killed a poodle, much to the distress of its lady owner, who, when he tried to offer comfort by a promise to replace the dog, was told: "Sir, you flatter yourself."

R. F. Uniacke, M.E.I.C., scored with a yarn about the surveyors whose work was so accurately done that they successfully drove their rods through the center hole of a buried grindstone, which had been used as a bench-mark.

A. St. Laurent, M.E.I.C., showed how the antipathy of a certain town council was changed to admiration for his work by the judicious provision of refreshments and sandwiches and something "of a kind not easily obtained now in Ontario," John Murphy, M.E.I.C., was good with stories of early telephone trials, when there were no facilities for "ring off", and A. Gray with one of a sectionman who left his work early to go home and on arrival found his wife sitting on the roadmaster's knee. He beat it back to work telling his colleagues that he was "nearly caught."

G. Gordon Gale, M.E.I.C., made a hit with a war story of the "mule skinners," but as a Rotarian, and with an eye to the Rotary wheel, he closed by remarking amid laughter that he would "rather be an extra spoke than another tire."

R. de B. Corriveau, M.E.I.C., told of his late chief, J. W. Fraser, and his early triumphs with certain concrete work, while G. B. Dodge gave particulars of the proposed changes in the calendar and their likely effect on some aspects of engineering.

C. P. EDWARDS—Minus his usual cheerful smile.

Commander Edwards told several stories, and in particular how the Fanning Island cable came to be cut by the Germans during the war through the fact of hidden equipment being disclosed in a copy of a wireless message thrown in a waste paper basket and discovered by the Germans.

There was a large attendance at the luncheon, which included A. W. Campbell, M.E.I.C., Fred. D. Burpee and others as guests.

Local News

Had Rudyard Kipling been present at the last meeting of the executive committee of the Ottawa Branch, he would mentally have repeated the couplet of his famous poem:

"But there is neither East nor West, Border nor
Breed, nor Birth,
When two strong men stand face to face, though
they come from the ends of the earth!"

At the table, with the members of the local committee were seated C. E. W. Dodwell, M.E.I.C., Chairman of the Halifax Branch, *Engineering Institute of Canada*, and President of the Association of Professional Engineers of the Province of Nova Scotia; and D. O. Lewis, M.E.I.C., of Vancouver, as guests. It seemed fitting that these men had been brought together at the capital of Canada, over a transcontinental railway which represent the solution of some of the greatest engineering problems ever undertaken. Mr. Lewis was a member of a deputation from British Columbia which was laying the particular claims of that province before the Railway Commission for readjustment of freight rates. The executive was very glad to welcome the two gentlemen to Ottawa.

The Council of Geodesy and Geophysics is to meet in Rome, Italy, on May 2, and from all indications a record attendance is expected. The Council is divided into two Unions, namely; the Union of Geodesy and Geophysics, and the Astronomical Union. Dr. E. Deville, Chairman, of the Canadian Committee of Geodesy and Geophysics, and Dr. Otto Klotz, Chairman of the Canadian Astronomical Committee, will be the delegates of Canada to the meeting.

Montreal Branch

J. L. Busfield, A.M.E.I.C., Secretary-Treasurer.

"Accident Prevention in Industrial Plants".

On Thursday evening, Feb. 23rd, an address on the above subject was given by W. G. H. Cam, A.M.E.I.C., The speaker set forth that the evolution of machine power for the cheap production of universally distributed commodities had been obtained at the cost of concurrent dis-service to society. During recent years there had been a definite effort to combat these conditions and in this accident prevention was one of the best moves towards solution. In the concrete industry, records showed that fifty percent of the fatal accidents and a large proportion of other accidents were due to the workmen themselves To prevent this, useful opportunity was afforded the Safety Engineer working through committees and educational litterature for the prevention of accident. There was a large attendance and the meeting was presided over by A. C. Tagge, M.E.I.C., Chairman of the Industrial Section of the Branch.

"Inductive Interference".

On Thursday evening, March 2nd, C. V. Christie, A.M.E.I.C., assistant professor of the Department of Electrical Engineering of McGill University read a paper on "Inductive Interference", P. S. Gregory, A.M.E.I.C., Chairman of the Electrical Section, presided at this meeting.

Presentation of Medals

Preceding the presentation of Prof. Christie's paper, Walter J. Francis, M.E.I.C., as senior vice-president of *The Institute* was called upon to make the presentation of the Gzowski, Plummer and Leonard Medals. In presenting the medals, Mr. Francis explained that *The Institute* was now presenting, in addition to the five students' prizes of $25 each, three gold medals, known as the Gzowski, Leonard and Plummer medals.

The Gzowski medal was founded by Colonel Sir Casimir S. Gzowski, one of the first presidents of the Canadian Society of Civil Engineers, 32 years ago, since when the list of recipients, year by year, included many of the outstanding members of the profession who had contributed papers of unusual merit.

This medal was originally of silver, but it had now been changed to a smaller design in gold. Mr. Francis explained that the three medals had now been standardized in size and design, the Gzowski being circular, the

Leonard having the irregular form of an ancient coin, while the Plummer medal was octagonal in form. The two latter had been designed by Frederick B. Brown, M.E.I.C. The obverse of the medals in each case bore the emblem of *The Institute*, a working beaver on a shield, together with the name of the medal: the reverse in each case outlined the scope of the subjects for which the awards were made.

The Gzowski medal was given in the field of civil engineering; the Leonard medal, the gift of Lieut.-Col. R. W. Leonard, of St. Catharines, Ont., past president of *The Institute*, for mining subjects; while the Plummer medal, donated by J. H. Plummer, was for papers in metallurgy and chemistry. The Leonard medal was open to members of *The Engineering Institute of Canada* and of the Canadian Institute of Mining and Metallurgy; but both of the others were restricted to the members of *The Engineering Institute of Canada.*

The Gzowski medal presented to P. Ackerman, A.M. E.I.C., was awarded in recognition of the merit of his paper entitled, "Relay Protective Features of the Toronto Transmission and Distribution Systems". Mr. Ackerman was a graduate of the Swiss Federal Polytechnical College, Zurich, Switzerland, and at the present time is in a high position in the engineering department of the Shawinigan Water and Power Company.

The Plummer medal awarded to Dr. Alfred Stansfield. M.E.I.C., was in recognition of his paper on "Recent Advances in Metallurgy", a very able and comprehensive resume of recent work in the metallurgical field. Dr. Stansfield was a well-known Montrealer, a graduate of London University and for many years professor of Metallurgy at McGill University.

The presentation of the Leonard medal was unique, inasmuch as it was presented to Lieut.-Col. Leonard, by *The Institute*, as the first medal struck from the dies. It was further unique in the fact that the gold from which it was made was practically pure, and was sent by Lieut.-Col. Leonard for the purpose. It was obtained from the refining processes at the Coniagas Mines of which he was the president. The regular award of this medal had not yet been made, but competitive papers were now being considered by the committee.

P. J. Ackerman was presented with the Gzowski medal amidst applause. In a brief reply he said that he had written his paper from a purely engineering standpoint, thinking it would be of very limited interest, and it was a most agreeable surprise to him to learn that it had been considered of such general interest to the engineering profession at large as to be worthy of such a prize.

In the absence of Dr. Alfred Stansfield, of McGill, the Plummer medal was received on his behalf by J. A. Sproule, A.M.E.I.C., who expressed Dr. Stansfield's thanks, with regrets that he had been compelled to attend the meeting of the Canadian Institute of Mining and Metallurgy at Ottawa, which prevented him being present to receive a highly prized honour, the more so as it expressed an appreciation of the work of the mining metallurgists.

The Coniagas gold Leonard medal was also presented in absentia, Lieut.-Col. R. W. Leonard being at present with the C.M.A. party in the West Indies, and was received by Councillor George R. McLeod, who made a brief response on behalf of Lieut.-Col. Leonard.

The Ruins of Babylon

Delving around among record of anywhere from five to seven thousand years ago, with concrete illustrations of cuneiform bricks made at a time when stenographers perpetrated their notes with hammer and chisel, Prof. R. A. MacLean, of McGill University, gave an interesting historical address to the Branch at the regular meeting on Thursday, March 9th.

Dr. MacLean's address was largely concerned with affairs in Babylon and Mesopotamia at a time six or seven thousand years ago, when modern conveniences were not considered. As an instance of this, he showed two samples of Babylonian baked bricks, on which were stenographic reports, nicely chiselled in hieroglyphic style. They were picturesque in their general effects, but undecipherable to the ordinary person of the present age.

Proceeding with his address, Professor MacLean showed the gradual transition from the civilization of the Babylonians, down to the recent periods when the British Expeditionary Forces took charge. This was a very long jump, as was shown by the efforts of the British forces in Mesopotamia to keep in touch with the ancient ideas of the inhabitants and to bring them in line with modern ideas.

Prof. MacLean's address was illustrated with a number of lantern slides, showing the details of the plans of ancient Babylon, with the engineering ideas they worked on.

A vote of thanks was moved by R. A. Ross, M.E.I.C., who pointed out the achievements of the ancient engineers as applied to the work of the engineers of to-day.

The meeting was presided over by Walter J. Francis, M.E.I.C.

Luncheon Meeting

On Thursday, March 16th, the second of the monthly luncheons was held and following the former practice a member of one of the sister professions was invited as the guest of honour.

On this occasion Rev. Dr. R. W. Dickie, president of the Protestant School Board of Montreal and Chairman of the Montreal Branch of the Toronto Alumni Association, addressed the meeting after the luncheon, which was held in the Mezzanine Dining Room of the C.P.R. Windsor station. The problems of society today, said Dr. Dickie, were principally questions of character. The principal role of the Church was to solve these problems of character and the speaker could conceive of no better or more effective way of solving these problems than by inculcating in the rising generation some form of sound, simple, spiritual faith.

Scientific Research in Canada

On Thursday evening, March 16th, Col. F. M. Gaudet, M.E.I.C., technical executive officer of the Honorary Technical Council for Scientific and Industrial Research, gave an address on "Scientific Industrial

Research in Canada" dealing particularly with the work of the Research Council. He emphasized that the application of science to our industries would reduce the cost of living and taxation.

The speaker said, that "A consequence of the war is that we have to raise money by mortgaging the future production of the country, and we are now paying as interest on this mortgage considerably more than the entire national expenditure before the war. The mortgage although expressed in money and measured in dollars must be paid in kind, and production must therefore be efficient, not only to enable buyers to buy, but also to provide means out of which the country will pay its debt.

For a country that is paying its way conveniently, the extent to which it seeks to improve its position may be optional; to a country that can depend at least on earning its living through its natural resources, the added security that can be had by scientific help, may safely be dispensed with, at some sacrifice of luxury; but, for a country situated as Canada is, to dispense with any practicable advance in the search of scientific assistance is sheer improvidence and recklessness."

Numerous examples were mentioned in which science had yielded handsome profits, and Col. Gaudet concluded by appealing to the members for their support in urging the Government to grant the request of the Research Council for the establishment of a National Research Institute in which science will co-operate with agriculture, industry and finance to increase the prosperity of Canada.

Following the paper a resolution was proposed by Fred. B. Brown, M.E.I.C., seconded by Prof. Chas. M. McKergow, M.E.I.C., and unanimously carried that the Montreal Branch of *The Institute* heartily endorsed the proposals of the Research Council for the establishment of a National Research Institute. The Secretary was instructed to send a copy of the resolution to the Premier and also to communicate with the local members of Parliament requesting them to support the establishment of the Research Institute.

Quebec Branch

Hector Cimon, A.M.E.I.C., Secretary-Treasurer.

Contracts and Specifications

T. E. Rousseau, A.M.E.I.C., was the lecturer at the regular meeting of this Branch which was held in the "Green Room" of the Chateau Frontenac, on Monday evening, the 27th of February.

Dealing with "Contracts and Specifications", Mr. Rousseau said that, under this heading, the engineer could find ample opportunity for exercising his technical knowledge and practical experience. Whether he be in private practice, in a corporation or in government service, his work would consist chiefly in preparing specifications and drafting contracts. He would also have to supervise the erection of the works specified and make sure that the contractor fulfills all the conditions set forth in the contract.

Specifications are a detailed statement of all the works to be executed and a true description of the materials to enter the construction of such works. Mr. Rousseau extensively discussed various cases which often occur in practice and enumerated the principal qualities which specifications should always embody, stating that engineers, besides making their specifications as technically perfect as possible, should make it an essential point that they be *fair* to the contractor.

With reference to contracts, by which it is made possible to demand legally that the contractor carry out the specifications, it may be said that they are of three kinds: — lump sum, unit prices and cost-plus. Mr. Rousseau stated that the contract at unit prices was to his mind, of all the forms of contract, the one which most recommends itself to the engineer, being just and equitable to all parties concerned.

In concluding, the speaker said that the engineer had much to gain by great care being used in the presentation of his specifications. He would have the satisfaction of seeing that his specifications would be followed to the letter to advantage by the contractor and that economy in construction and efficiency would result, which are assuredly the principal aims in the work of an engineer.

Following that very able lecture, a most interesting discussion took place regarding certain points brought out by the speaker. Messrs I. E. Vallée, Alex. Fraser, Z. Langlais, J. E. Gibault, O. H. Côté, Art. Fournier, A. R. Décary expressed their views on the matter, and, finally, the Chairman, Mr. Décary, thanked the lecturer and congratulated him on the most successful manner with which he had presented his paper and the fine and clean discussion which he had raised.

Fraser S. Keith's visit

Members attending our meeting of February 27th, had the pleasure of meeting the general Secretary, Mr. Keith, who was good enough to accept the invitation of this Branch and came to Quebec for the express purpose of addressing our members on Society affairs.

This first visit of *The Institute's* Secretary to the Quebec Branch was very much appreciated and, no doubt, Mr. Keith has made quite a number of new friends in the Old City.

After being introduced by Chairman A. R. Décary, M.E.I.C., who expressed the feelings of all in cordially welcoming the Secretary, Mr. Keith said that he was delighted to be among the members of this Branch and that he was very pleased indeed with the good work which is being done here. He then delivered a talk reviewing the activities of *The Institute* for five years, outlining the present situation, making clear the advantages for engineers in being members of our *Institute,*— a unique representative body of the profession in this country,— and stating some of the achievements which are expected to be worked out in the future for the welfare of our members.

A vote of thanks was then moved to the General Secretary by Messrs. J. E. Gibault, A.M.E.I.C., and S. L. deCarteret, A.M.E.I.C., for his most interesting address, the good news he had brought from headquarters and the very kind words he had said about our Branch:— cheerfully carried.

Bringing the meeting to a close, Chairman A. R. Décary asked Mr. Keith to give the Council of *The Institute* the compliments of the Quebec Branch, and to assure them of our most faithful co-operation.

Technical Training for Skilled Labourers

Technical education, its history, its advantages and its possibilities formed the main theme of an elaborate address delivered by J. A. Buteau, A.M.E.I.C., professor at the Quebec Technical School, at the luncheon held by this Branch on Monday, March 13th, at the Chateau Frontenac.

Mayor Samson was the guest of the Branch and also addressed the meeting, expressing his satisfaction, as the Mayor of Quebec, to note the good spirit which exists among engineers as in other professional bodies and business-men clubs in the City of Quebec. Meetings like this one, he said, are the very thing to develop ideas or to bring out before the public facts which may lead to important improvements of wide application in our civic, social or even national activities. Referring to technical education, Mayor Samson said that real experts in all trades are still badly needed in this country; one must pay to learn something and, when we do not pay to get the proper training in schools, we find too often that experience is a teacher that makes us pay very dear, indeed, for its practical lessons; the technical schools of this province are the best means of securing or preparing the trained workmen and technicians upon the shoulders of whom will largely rest the industrial development of our province and of our city.

This form of specialized education, Mr. Buteau said, was first instituted in France in 1870, European universities taking it up almost immediately until, in 1878, the system was started in England, finally becoming the vogue in the United States and Canada. The system was first started in Canada in 1900, the Ottawa Chamber of Commerce inaugurating the policy. In time, it was taken up by practically every Chamber of Commerce in the Country, the Canadian Manufacturers' Association finally putting the seal of its approval upon it. The first technical school opened in this province was inaugurated in Montreal in 1911. To-day, there are such schools all over the province. The training is both manual and theoretic and is offered to pupils of primary grades of the age of fourteen; it lasts three years and equips the graduates with full theoretical and practical knowledge of mechanics, foundry work, joining and modelling.

The speaker concluded by reminding his audience that the technical education of the youth of this country is one of the most potent means of offsetting the present industrial unrest.

A. B. Normandin, Esq., A.M.E.I.C., added a few words on the subject and moved a hearty vote of thanks to the speaker of the day, which was carried with great applauses.

J. E. Gibault, Esq., A.M.E.I.C., who had presided at the meeting in a very able manner, again thanked Mayor Samson for his kind acceptance of the invitation of this Branch and for the most practical way in which he had been good enough to address the meeting.

Municipal Management

A joint meeting of this Branch of *The Engineering Institute of Canada* and of la Société des Arts, Sciences et Lettres de Québec was held at the City Hall on Tuesday evening, March 14th.

The meeting was presided over jointly by Messrs A. E. Doucet, M.E.I.C., for this Branch and G. C. Piché, A.M.E.I.C., for la Société A. S. et L.

The speaker was Henri Ortiz, C.E., manager of the Town of Grand'Mère, who was introduced by Mr. Doucet.

After making known the history of the system of municipal administration by a manager, which only dates back to 1907 and was inaugurated at Staunton, in the United States, Mr. Ortiz stated that 254 cities or towns had adopted this system in the United States and Canada. He then made the comparison between the various systems now in use and clearly presented the advantages of the new and business-like method, which he strongly advocated. Finally, the speaker gave account of the results obtained at Grand'Mère with the new system which replaced the ordinary "City Council" method only two years ago.

A number of lantern slides illustrating the many modern features of the Town of Grand'Mère were next thrown on the screen and proved to be quite interesting.

G. C. Piché then said that he was sure to meet the approval of all present in telling Mr. Ortiz how his lecture had been enjoyed by all and how thankful to him were the members of the two societies whom he so well entertained.

St. John Branch.

Harry F. Bennett, A.M.E.I.C., Secretary-Treasurer.

C. McN. Steeves, M.E.I.C., was the speaker at the regular meeting of the Branch on Thursday, Feb. 16th. The subject of his paper was "The Sub-structure of the International Bridge at Edmundston, N.B."

The international boundary between New Brunswick and the state of Maine follows the Upper St. John River for a considerable distance. The nearest bridge crossing to Edmundston was at St. Leonards, about 26 miles south. Edmundston, with a population of about 5,000, is the large trading centre for the country on both sides of the river, and this bridge has been built at this point to serve the adjacent communities as well as to connect the splendid highways on each side. The river is 850 feet wide at high water level.

The bridge is carried on three piers and two abutments the tops of the piers being generally 58 feet 5 inches above low water summer level. The height of the bridge was necessitated by the crossing of the Temiscouata and Transcontinental Railway tracks on the Canadian side.

No extraordinary difficulties were encountered in the construction, the interesting features being the stiffness of the excavated materials in the pier footings which had to be picked out by hand after a crib protection wall and coffer dam had been placed; and the use of a pontoon bridge for carrying construction materials from shore to the piers. This was used in preference to a trestle as the headwaters of the river held a large quantity of logs awaiting a rise in water to facilitate driving, and an extra

high rise in water would not affect the pontoon bridge. When the logs did come down the pontoon bridge was found to be ideal and no inconvenience resulted either to the contractors or the lumbermen.

The piers are generally 68 feet high and rest on hard pan. River sand and gravel were used in the concrete and after several tests had been made, a temporary screening plant was dispensed with and the natural run of bank gravel used.

The sub-structure was built by D. C. Burpee and Son, of Devon, N.B., with whom Mr. Steeves is associated. The superstructure is being placed at the present time.

Visit to Power House

An opportunity was afforded the members of the Branch to visit the power house of the N.B. Power Co. at St. John on Saturday Feb. 18th. The party was taken through the plant by H. A. Brown, chief engineer of the company, and J. D. Garey, engineer in charge of the power house.

The March meeting of the Branch was held on Thursday, March 16th, when D. L. Hutchinson, "affiliate of the Branch", Director of the local Meteorological Observatory, addressed the members on "Winds and Weather".

After dealing with the technical side of the Meteorological Department and explaining the collection of the weather information and the preparation of forecasts, Mr. Hutchinson talked interestingly of the various popular modes of predicting weather. He scouted the idea that Indians, birds, or animals had any instinctive knowledge of weather forecasting or that the moon in its different phases had any influence on weather conditions.

While the popular opinion, among outsiders, was that the Bay of Fundy was the home of fogs, Mr. Hutchinson explained that they are produced by warm, moist currents of air from the Gulf Stream flowing over the colder surfaces of the sea in more northern latitudes. With a southerly wind prevailing outside, these fog banks drift towards our shore and remain while the wind is from a southerly quarter. With a high barometer at Bermuda and a low pressure area moving slowly through the St. Lawrence Valley, fogs may be expected in the Bay of Fundy.

As examples of intensive rainfall in St. John, Mr. Hutchinson stated that in Jule 1901, 4.32 inches of rain fell in ten hours, and during October 1900, 8.33 inches fell in 68 hours.

The paper was splendidly illustrated by lantern slides among them being an etching of the first steam fog alarm whistle in the world, designed by Robert Foulis, C.E., in 1854, and erected on Partridge Island, St. John, in 1859.

At the conclusion of the address a vote of thanks to the speaker was moved by H. F. Bennett and seconded by G. H. Waring.

The Association of Professional Engineers of New Brunswick has announced the reduction in annual dues from $10.00 to $7.00.

Moncton Branch

M. J. Murphy, A.M.E.I.C., Secretary-Treasurer.

A Supper Meeting of Moncton Branch was held in the Palm Room of the Brunswick Hotel on Thursday evening, February 2nd. J. D. McBeath, M.E.I.C., Chairman, presided.

It was brought to the notice of the meeting that honours had recently been bestowed on three gentlemen holding executive offices in the Moncton Branch, viz., A. F. Stewart, M.E.I.C., chief engineer, Canadian National Railways, Eastern Lines, had been elected to the Council of *The Institute;* S. B. Wass, A.M.E.I.C., construction engineer, Canadian National Railways, Eastern Lines, had been elected President of the Association of Professional Engineers of the Province of New Brunswick; and J. D. McBeath, M.E.I.C., asst. city engineer, of the City of Moncton, had been elected to the Council of the Association of Professional Engineers of N.B.

Town Planning

H. B. Pickings, A.M.E.I.C., of the firm of Pickings and Rowlings, Halifax, gave a very interesting and instructive address on town planning. Mr. Pickings at the outset of his paper quoted Charles Mulford Robinson, who in his introduction to "City Planning" says: "Town Planning includes three operations. The term is applied to the replanning of existing cities and towns, the planning of new towns and scientific plotting of new sections of existing towns. The benefits that are sought by it are, in their turn, speaking broadly, three in number. They are an improvement in those circulatory conditions created by indirect streets and congested traffic, the betterment of social conditions in many directions—notably in that of housing, and an increase in the visible beauty and splendor of cities. Under these headings, gains are anticipated in economy, efficiency, health, comfort and looks."

Mr. Pickings said in part: Town Planning is fundamentally an engineering problem. By this I do not mean to assert that all engineers should be primarily town planners, or that town planning cannot or should not be undertaken by other than engineers. I do say however that town planning from its inception, is an undertaking that required constant engineering in both design and supervising.

The fundamentals of town planning are street planning, subdivisions, building restrictions, park and recreation facilities and districting or zoning. Their relation to each other is so close that town planning fails when any one of them is not given its true place in the whole.

Streets—Whether the development be rural or urban, streets form the framework upon which the village, town or ultimate city will develop. Town planning is primarily planning for the future, so in dealing with the street problem I do so from the city standpoint. As the city is complex and varied in its life so must its streets be. We have first our main traffic streets which may be few or many in number depending on the size of the city. They as the name implies, form the main arteries of the community, provide the means of getting into and out of the

city and are the channels through which it is possible to get from one section to the other. Some are wholly, others partially and the majority likely to become business streets.

The real value of the Town Planning scheme and that by which it will be finally judged might be said to be found in its regulations, governing erection of buildings and the control of the development of the various sections of the city and known as districting or zoning regulations. Building restrictions govern the set back by application of building lines, the height of the building, the proportion of the lot they cover and their class. Districting or zoning regulations designate and govern the area in which these restrictions shall apply and limit the number of dwellings to be erected to the acre. Set back or building lines are intended to achieve two purposes, the first to enable future street widening at a minimum cost and disturbance and secondly to preserve alignment by requirement of a minimum space between the fronts of buildings. Height regulations are a guarantee that a property owner cannot overshadow his neighbour by the erect on of towering structures and thereby rob him of his proportion of light and air. Districting or zoning regulations require that manufacturing plants will not encroach upon retail business or residential areas and they designate the areas in which apartment houses, flats or group dwellings may or may not be erected and govern the density of population.

There are few cities adequately provided with parks and recreation areas. These areas may be classified as wild parks, semi-cultured parks, public gardens, play grounds, open spaces or squares and athletic grounds. I do not know of any other adequate basis by which to suggest what proportion of a city should be reserved for areas of this character.

Mr. Pickings paper was followed with very keen interest, and it was very much appreciated by members of the Branch.

J. D. McBeath, M.E.I.C., on tendering a vote of thanks to Mr. Pickings spoke briefly on the advantages that town planning was to every city if carried out properly.

During the evening Mrs. Harold Price sang beautifully "Sweet Early Violet" and for the encore rendered "The Sweetest Flower that Blows". Mr. Elliott also rendered a solo in a very pleasing manner. W. A. McKee was the accompanist.

Halifax Branch

O. S. Cox, A.M.E.I.C., Secretary-Treasurer.

A Lump of Coal

The regular monthly meeting of the Branch was held in the Nova Scotia Technical College at 8 P.M., Feb. 16th. Owing to the extreme inclemency of the weather the attendance was small, which was especially unfortunate as a very valuable paper was presented by K. L. Dawson, A.M.E.I.C., on "A Lump of Coal." The following are some extracts from Mr. Dawson's paper:—

Coal finds its place in our economic scheme because nature does not create and destroy indiscriminately. The variety of its constituents and the complexity of their composition cause extreme difficulty in their isolation even by those who are most skilful in laboratory operations.

The combustion of raw coal is wasteful because it is impossible to control the reactions which precede and accompany the decomposition of the coal substance. Especially is this true for its use in stoves and small furnaces. From the standpoint of the conservation of our national resources such use of coal is condemnable. Modern improvements give large efficiencies to boiler and furnace yet there is a very great discrepancy between the amount of useful heat and the amount of potential heat in the original coal, with no by-product except ashes.

The full use of the dense raw coal naturally lies in its transformation into fuels of higher availability such as gas, oils, tar and coke. Commercially this phenomenon is carried on in two high temperature processes, coke oven and gas works practices. The first aims chiefly at Coke, and the other at Gas. In each the other is the chief by-product. Both processes require a certain amount of volatile matter, otherwise the amount of the distillate obtained is inadequate to warrant the cost of operation, or the quality of the residue is so poor that no coherent coke can be isolated. Coals containing 16 to 40 percent can be coked but coke-oven practice demands 18% to 33%. For each process present equipment demands a sulphur content of less than 1¼% but it is very probable that a method will be found for utilizing coals containing more sulphur.

Using as an example the method of distilling coal used by the Nova Scotia Tram and Power Company to produce the gas used in Halifax, the author shewed that the manufacture of gas is not a simple and self-regulating process but one requiring engineering skill in the application of physical and chemical theory to both the design and the operation of equipment. Some recently installed apparatus, developed locally, which washes the gas with oil, removes twenty grains of organic sulphur per hundred cubic feet of gas and permits the use of Nova Scotia coals containing about 2.25% sulphur.

From the distillation of coal there are several main products of which the most important in our present economic scheme are known as gas, coke and tar.

Industrial concerns have already found upwards of 2000 uses for gas in various manufacturing processes and thousands of plants would close if gas-service were suspended. Although gas has practically withdrawn from the lighting field it is false to say that electricity has conquered her.

Probably the chief distinction between coal and coke is the almost entire lack of volatile matter in, and the porous structure of the latter, which qualities enable it to be consumed and converted in a single stage and at a high temperature directly to carbon dioxide. Chemically considered, coke consists of carbon, together with all the mineral constituents contained in the coal from which it is made. It contains only a trace of hydrogen. The amount of carbon varies from 85 to 95% and the ash from 5 to 15%. Fired in furnaces under correct conditions

of balanced draft, the formation of carbon monoxide gas can be largely avoided. Judged by its analysis coke should not have a calorific intensity superior to coal, such as it possesses as evidenced by its use for metal-melting and other high temperature processes.

The explanation probably is that the process of combustion being already far advanced by the heat absorbing process of distillation, less heat is required to gasify it than is necessary in the case of coal. There is also a marked difference in the specific heats of coal and coke. Coke does not have the chilling effect of fresh coal when thrown upon an incandescent fire, and, being almost entirely free from hydrogen, it burns without the formation of water. By using the "sandwich" system for blending coal and coke large quantities of coke are now being consumed with very inferior grades of coal, giving greater efficiencies than can be developed from coal allne, even when burned on chain grates.

Tar, which formerly was a waste product, polluting rivers and ponds, is now a very valuable commodity. It is used to some extent in its original form but finds its most important application in the arts where it forms the basis of aniline colour production, 392 colours and shades being listed as coming from tar. From it we obtain also creosote, carbolic acid, naphthalene, anthracene andben zol, each of which in turn gives rise to a long series of other products.

Considering the number of combinations of different primary products which are possible when they are heated under conditions permitting the temperature and pressure to be independently varied, it is obvious that a great amount of useful work can be done in following up the secondary decompositions. This applies to both coal and tar and particularly lends itself to laboratory methods of investigation.

Is it more important to develop means of utilizing inferior fuels than to develop more efficient means of utilizing the economic good in our best fuels? Whatever arguments may arise in the mind for or against the question, it is a fact that the supply of our best fuels is not unlimited. It is a significant fact that the United States has begun to import oil. New methods of coal and tar distillations will undoubtedly be developed if for no other reason than to produce a fuel for motor vehicles.

Encouragement for the woik of the Advisory Research Council and of individual effort is eminently necessary.

Mr. Dawson's paper was illustrated by a number of interesting lantern slides and a motion picture film.

Air Board Specifications

A list of the Canadian Air Board Specifications for Aircraft Materials and Components has been received from F. C. Higgins, A.M.E.I.C., intelligence officer, the Canadian Air Board, which is complete to January 1922, the information contained in which is available to all members of *The Institute* through the Institute Library. The specifications include: bolts; brass, copper and bronze; dope and ingredients; electrical; fabric; alloys; petrol, oil; steels; tubes; timber, glue; wires, wire ropes; paints and varnishes.

The official listing is given herewith:—

A. Bolts, etc. List No. 2, January 1922.

2 A 1. Bright Steel Bolts and Nuts, B.S.F. Threads.
A 4. Test pieces (Tensile, Bend and Notched Bar).
B. Brass, Copper and Bronze
B 1. High Tensile Copper Alloy Bars.
B 2. Gunmetal Castings.
2 B 4. Copper Sheets (annealed).
2 B 5. Brass Sheets (hard rolled).
B 6. Naval Brass Bars.
B 11. Brass Bars for Brazing or Silver Soldering.
2 B 12. Brass Sheets (annealed).
D. Dope and Ingredients
2 D 1. Methyl Ethyl Ketone.
2 D 6. Cellulose Acetate.
2 D 7. Benzyl Alcohol.
2 D 9. Alcohol.
2 D 10. Benzol.
3 D 12. Triphenyl Phosphate.
D 13. Methyl Acetate.
2 D 15. Distillation Apparatus.
2 D 22. Acetone.
3 D100. Air Ministry Cellulose Acetate Dope.
E. Electrical
3 E 1. High Tension Electric Ignition Cables.
4 E 3. Low Tension Flexible Electric Cords and Cables. Add *.
E 16. Copper-Asbestos Washers for Sparking Plugs.
F. Fabric, etc.
3 F 1. Linen Aeroplane Fabric (Grade 1).
2 F 7. Rubber Tubing.
L. Alloys
L 4. Aluminum Sheets.
P. Petrol, Oil, etc.
P 1. Petrol.
S. Steels
2 S 1. Part 1. Medium Carbon Steel Bars (bright drawn)
2 S 1. Part 2. Medium Carbon Steel Bars (hot rolled)
S 3. Mild Steel Sheets (for welding).
S 21. "20" Carbon Steel Bars.
T. Tubes
T 1. 35-Ton Carbon Steel Tubes.
T 6. Mild Steel Tubes (hard drawn and blued)
3 T 7. Seamless Copper Tubes.
T 10. Schedule of Standard Sizes of Round Steel Tubes.
T 11. Schedule of Standard Sizes of Oval Steel Tubes.
2 T 12. Schedule of Standard Sizes of Steel Tubes of special sections.
T 21. Annealed Carbon Steel Tubes.
T 26. Mild Steel Tubes (half hard or fully softened).
V. Timber, Glue, etc.
2 V 1. Silver Spruce and approved substitutes.
V 2. Casein Cement.
V 3. Plywood.
W. Wires, Wire Ropes, etc.
2 W 1. High Tensile Steel Wire.
2 W 2. Flexible Steel Wire Rope.
X. Paints and Varnishes
2 X 4. White Dope Resisting Paint.
General Clauses dealing with Inspection

NOTE: — * "Add" signifies that an addendum or corigendum slip is issued with these Specifications.

List No. 2 will be amended from time to time to include any new, revised, or superseding Specifications, and should be destroyed upon receipt of the number superseding it.

Town Planning Notes and Comments

Horace L. Seymour, A.M.E.I.C.

NOTE. — *In order to make this column of wide interest to members of The Institute, personals and items of town planning interest will be appreciated. Address: Horace L. Seymour, A.M.E.I.C., 40 Jarvis Street, Toronto.*

Report of Town Planning Committee Toronto Branch

It has become a matter of general belief in *The Engineering Institute of Canada* that the engineer should be a leader in public affairs. In no sphere of community usefulness is the engineer's influence more needed than in that of town planning — this is possibly not a matter of general belief, but it is a truth held strongly by more than one engineer.

The report of the Committee on Town Planning of the Toronto Branch is concerned this year with a review of town planning activity in Ontario, with particular reference to Toronto. The Planning and Development Act grants control to cities, towns and villages in the matter of street location in undeveloped areas within the municipal limits and over an urban zone of several miles in extent surrounding the municipality. The Act does not in any way. however, give control over building development. The municipal and other acts grant certain by-law power to councils of municipalities with respect to building development within the municipality itself, but not in any urban zone. The city of Toronto controls the layout of streets and subdivisions within the city and within the urban zone extending five miles from its boundaries. It can, and does insist, for example, in certain cases, on streets of greater width than the usual 66 feet. All concession and most main travelled roads are being widened as subdivision takes place, but the city has no power outside its own limits to insist before subdivision on buildings being kept back to allow for the projected widening. Taking advantage of the amendments to the Municipal Act passed last year, it is understood that the township of York is preparing by-laws that will prescribe building lines on all those roads or streets in the Toronto urban zone that the city plans to widen. In its private bill it is also understood that the township of York is asking for five percent dedication for parks in all new subdivisions, the intention being to consolidate these small park areas so obtained.

The Planning and Development Act provides for the appointment of a Town Planning Commission. It may be stated in general, that, the city of Toronto being one exception,town planning activity has been greatest where a Town Planning Commission or Committee has been appointed. There might be mentioned the cities or towns of Ottawa, Oshawa, Hamilton, St. Catharines, Kitchener, Waterloo, Guelph, Brantford, Niagara Falls, London and Welland, and the Essex Border Utilities Commission.

Interest in town planning in New Ontario has been stimulated by a recent paper by H. T. Routly, A.M.E.I.C., on "The Development of Townsites in New Ontario". This paper was read before the annual meeting of the Association of Ontario Land Surveyors, last month. Mr. Routly pointed out the evils of haphazard development in the North and he showed that town planning was not something of a fad or something of a luxury, but a stern necessity in the development of the North country. With regard to that country he said that it was one that gave not only an opportunity to the town planner, but from which there was a call of duty to the town planner. It is understood that a committee of surveyors has been formed to devise ways and means for the intelligent control of townsites in Northern Ontario.

The Ontario Town Planning and Housing Conference, composed largely of representatives from various municipalities, recently sent a delegation to wait on the premier. Premier Drury's attention was drawn to the fact that town planning legislation was scattered through various acts, and that in consequence, the average municipality in Ontario did not know its powers. The premier promised consideration in the consolidation or codification of town planning powers and it understood in this connection that a Committee of the House is to be appointed.

There are some seventy-five members of the Town Planning Institute of Canada. Of this number some 30 are engineers. The Toronto Branch has a membership of about thirty, with a regular membership of about half that number. The programme for last season was an excellent one, papers being read by several members of the Toronto Branch of *The Engineering Institute of Canada.*

Since town planning is essentially a matter of economy, it means that sooner or later business organizations will become interested. Many examples of this "commercial urge", both in Canada and the United States might be cited, and in our own city of Toronto the Downtown Association, an organization of business men has been actively interested in town planning. It requested some months ago representation from the various Toronto bodies, technical or otherwise, that were interested in town planning. The Chairman of this Town Planning Committee represented the Toronto Branch of *The Engineering Institute of Canada.* There were also representatives from the Architectural and Town Planning Associations and from the Civic Guild. This latter organization for years has been urging many measures for the betterment of Toronto and has been successful in obtaining valuable legislative powers relating to town planning.

The result of the activity of the Downtown Association has been that the attention of the Mayor and Council has been brought to the necessity of appointing some commission in Toronto to take care of town planning matters, in particular that of street widening and street extensions, and before the year is out it is hoped that some definite action will have been taken.

If the engineer is to lead in public matters, now is the time for him to assist in the town planning movement by using his influence with all those with whom he comes in contact. Education is still needed, not only of the public, but of those elected to deal with public matters.

Let us be inspired by the action of the Sault Ste. Marie Branch of *The Engineering Institute of Canada.* The Secretary reports: "It is our intention to stimulate public interest in the Sault in a city planning movement. Already we have secured the promise of co-operation and support from a number of local public bodies".

Preliminary Notice

of Applications for Admission and for Transfer

March 20th, 1922

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate member a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in April, 1922.

FRASER S. KEITH, Secretary.

*The professional requirements are as follows —

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option, Railway, Municipal, Hydraulic, Mechanical, Mining or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidat. has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years oe age, and must have been engaged in some branch of engineering for at least four years! This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects, Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits cientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

> The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

AKINS—JAMES ROBERT, of Ottawa, Ont. Born at Kinburn, Ont., Sept 2nd, 1876; Educ., B. Sc. Queen's Univ. 1907. D.L.S., A.L.S.; Since graduation [illegible] in various parts of western Canada, chief of party since 1910; 1919 to date chief of party, Topog'l Surveys Branch, Dept., of the Interior, Ottawa, Ont.

References: J. L. Rannie, J. D. Craig, F. M. Dennis, F. V. Seibert, W. C. Way, G. H. Herriot, A. W. Haddow, A. Macphail.

BENNETT—GEORGE ARTHUR, of 561 Gilmour Street, Ottawa, Ont. Born at Eden, Ont., May 18th, 1886; Educ., B.A.Sc. (C.E.), Univ. of Toronto, 1910. D.L.S., A.L.S., 1907, divisional surveying C.P.R.; 1908 articled asst., D.L.S., 1910 asst. on D.L.S. for Dept. of the Interior, and from 1911 to date, chief of party, Topog'l. Surveys Branch, Dept. of the Interior, Ottawa, Ont.

References: G. H. Herriot, G. B. Dodge, P. Gillespie, P. E. Palmer, R. C. Purser, S. D. Fawcett.

BISSON—JOSEPH LEONARD, of Fort William, Ont. Born at Hull, Que. Nov. 24th, 1886; Educ., B.Sc., (C.E.), McGill Univ. 1912; 1902, foreman on constrn. coffer dam and concrete work, Ottawa and Hull Power Co.; 1907, stop logs, Big Chaudiere Dam, Ottawa; 1910 and 1912, supt. on constrn. of coffer dams, laying water mains, extension to city power house, Hull, Que.; 1912-18, asst. engr. and 1918 to date, senior asst. engr., Dept. Public Works, Canada, at Fort William, Ont.

References: H. B. R. Craig, G. H. Burbidge, J. A. Laniel, J. E. St. Laurent, G. R. Duncan.

CHRISTIE—WILLIAM, of Ottawa, Ont., Born at Sullivan Township, Grey Co., Ont., Feb. 13th, 1876; Educ., B.A.Sc., Univ. of Toronto, 1902, D.L.S., S.L.S.; 1903-06, asst., and 1907 to date, chief of party on different govt. surveys. At present, surveyor engineer, Topog'l. Surveys Branch, Dept. of the Interior, Ottawa, Ont.

References: G. H. Herriot. G. H. Blanchet, F. V. Seibert, S. D. Fawcett, A. L. Cumming.

CLARK—HIAL JACKSON, of 64 Bridge Street West, Belleville, Ont. Born at Wellington, Ont., Aug. 21st, 1888; Educ., B.A.Sc., Univ. of Toronto, 1912; 1911 (Summer), asst. and instr'man., to J. W. Fitzgerald, O.L.S.; 1912-13, asst. to J. D. Shapley, S.L.S., A.L.S., D.L.S., North Battleford, Sask.; 1914, dfting office and motor survey of county roads, Ontario Dept. Public Works; 1914-16, instr'man. and res. engr., in charge of constrn. work, Toronto-Hamilton concrete highway; 1916-19, asst. to City Engr., Hamilton; 1919-20, res. engr., Hamilton-London Prov. Highway; 1920-21, supt. of constrn. for Johnson Bros. Highway Contractors, Brantford, Ont.; 1921 to date, asst. and supt. for H. T. Routley, highway contractor and engr., Toronto.

References: H. T. Routly, G. Hogarth, W. A. McLean, E. R. Gray, H. S. Van-Scoyoc, C. Johnston, J. E. N. Cauchon, J. J. MacKay.

COLE—DONALD, of 399 Monterey Avenue, Detroit, Mich., U.S.A. Born at Baltimore, Md., U.S.A., Nov. 29th, 1885; Educ., Baltimore City College; 1903-06, dftsman. with the following firms, The Arctic Machine Co., Canton, O., Frick Co., Waynesboro, Pa., The William Tod Co., Youngstown, O.; 1906-11, with the Arctic Ice Machine Co., Canton, O., as follows:—1906-08, chief dftsman. and designer, 1908-09, sales engr., 1909-11, asst. chief engr.; 1911-14, asst. engr., in charge of dfting. room and design of automobile axles; The Tunken-Detroit Axle Co., Detroit, Mich.; 1914-17, chief of plants, in complete charge of all mechanical equipment and plant properties, The General Ice Delivery Co., Detroit; 1917-20, U.S. Army, as civilian refrigerating engr., and later Capt., Q.M. Corps, constrn. divn.; 1920 to date, consltg. engr., specializing in refrigeration in all forms. Member, A.S.R.E., and A.S.M.E.

References: A. A. Bowman, G. A. Johnson, O. J. Hein, A. DesRosiers, A. J. M. Bowman.

DALE—WILLIAM PERCIVAL, of 297 Second Avenue, Niagara Falls, Ont. Born at Brampton, Ont., April 1st, 1894; Educ., B.A.Sc., Univ. of Toronto, 1920; 1911-12 (summers), asst. dftsman., Canada Producer and Gas Engine Co., Barrie; 1913-14 (summers), rodman, levelman, dftsman., Town of Brampton; 1916-19, overseas, Can. Engrs.; 1920-22, asst. laboratory engr., H.E.P.C. of Ontario; At present township engr., for the township of Stamford, Welland County.

References: A. C. D. Blanchard, W. P. Dobson, C. R. Young, R. B. Young, T. V. McCarthy, R. P. Johnson, J. A. G. White, F. W. Clark.

FRASER—ROBERT JAMES, of Ottawa, Ont. Born at Ottawa, Ont., Sept. 9th, 1887; Educ., 1907-08, Faculty of Applied Science, McGill Univ.; 1908-09, junior asst., hydrographic surveyor, 1910-16, senior asst. hydrographic surveyor, 1917, officer in charge, hydrographic surveys, Bay of Fundy, 1920, hydrographer; and officer in charge, Great Lakes Hydrographic Surveys, and 1921 to date, hydrographer and officer in charge, Gulf of St. Lawrence Hydrographic Surveys, Dept. of the Naval Service, Ottawa. 1918-19, Lieut., R.N.V.R.

References: W. J. Stewart, F. Anderson, B. H. Fraser, S. J. Chapleau, C. P. Edwards, J. L. Rannie, R. M. Cameron.

GARLAND—CHARLES H. B., of 178 Cartier Street, Ottawa, Ont. Born at Ottawa, Ont., Aug. 21st, 1892; Educ., Grad. R.M.C. Kingston, 1913; 1913-14, instrument work with Federal Plan Commission of Ottawa and Hull; 1914-17, overseas; 1918-19, pneumatic caisson work, Fraser Brace & Co.; 1919 to date, asst. to engr. in charge, designing and field work, Geo. C. Graves Constrn. Co., Ottawa.

References: J. A. Ewart, J. B. Cochrane, J. B. McRae, H. W. Tate, R. D. Sutherland, R. M. Calvin.

GOODWIN—LEO. FRANK, of Kingston, Ont. Born at Vienna, Austria, June 1st, 1879; Educ., Grad. (A.C.G.I.) civil and mech. engr'g., Engr'g. College, Imperial College Science, London, 1898. Ph. D. Heidelberg, 1903. Post Graduate student and demonstrator, University College, London, 1903-05. Fellow Institute Chemistry, Great Britain, 1905; 1905-06, Chief Carnegie research asst. to Prof. Chas. Baskerville, New York; 1909 to date, partner with Capt. C. J. Goodwin, B.Sc., A.M. I.C.E., in Oscar Guttman & Sons., Consltg. Engrs., and Chemical Advisers; 1914-16, Major, C.E.F. Seconded as technical adviser War Office, and Master General of Ordnance, Canada; 1920-21, and at present, professor, chemical engr'g , Queen's University, Kingston. Occasional consltg. work. Retained as consultant by a Canadian pulp and paper company, and an English Explosives Company.

References: A. Macphail, L. M. Arkley, W. P. Wilgar, W. L. Malcolm, D. S. Ellis, L. T. Rutledge.

GREEN—LESLIE THOMPSON, of 22 O'Hara Avenue, Toronto, Ont. Born at Brantford, Ont., Oct. 17th, 1893; Educ., I.C.S.; 1910-13, ap'ticeship. in arch'ture, L. D. Barber, Architect, Brantford, Ont.; 1913-17, engr'g. dftsman. and designer on concret work, Trussed Concrete Steel Co., Vancouver, Winnipeg, Walkerville and Toronto; mgr., steel sask dept., 1917 and office mgr., 1918 for Toronto office of same company; 1919 (6 mos.), chief arch't'l. dftsman., for F. W. Warren, Hamilton, Ont.; 1919 to date, chief engr'g. dftsman. and designer for R. E. W. Hagarty, Consltg. Engr., Totonto, Ont.

References: R. E. W. Hagarty, E. S. Mattice, A. H. Harkness, C. S. L. Hertzberg, F. W. Taylor-Bailey, J. L. G. Stuart, T. D. Mylrea.

HAMEL—FERNAND OMER, of Ottawa, Ont. Born at Ottawa, Ont., Sept., 9th, 1882; Educ., Grad. Commercial Course and 1 year classics, Univ. of Ottawa; dftsman. for F. M. Hamel, C.E.; 14 years to date with Dept. Public Works, Heating and Ventilation, preparing mech. layouts, and for the last six years in full charge of the design, supervision of constrn., estimating, specification writing, of all central and other heating plants, ventilating and vacuum cleaning systems etc., of all public bldgs., and mil. hospitals under charge of the chief architect of this department. At present acting senior mech. engr., Heating and Ventilation, Dept. Public Works, Ottawa, Ont.

References: A. P. Deroche, A. St. Laurent, J. Houlston, D. A. Williamson, J. J. McNiven.

HARCOURT—FREDERICK YOUNG, of Port Arthur, Ont. Born at Welland, Ont., July 31st, 1879; Educ., B.A. Univ. of Toronto, 1900. Grad. S.P.S., 1903; 1903-05, rodman, instr'man. and chief of field party, Ontario Power Co., Niagara Falls, Ont.; 1905-07, instr'man., Georgeian Bay Canal survey; 1907-11, senior asst. engr., Port Arthur District, Public Works, Canada; 1915-19, overseas; 1911-15 and 1919-1921, district engr., Port Arthur District, and 1921 to date, district engr., Port Arthur and Fort William District, Public Works, Canada.

References: A. St. Laurent, K. M. Cameron, H. J. Lamb, H. G. Acres, C. H. Mitchell.

HAWTHORNE—GEORGE, of Campbellford, Ont.Born at Calvin, Ont., May 19th, 1889; 1906-08, rodman, etc., prelim. and location surveys, C.P.R.; 1910-11, force account timekeeper, Algoma Eastern Rly.; 1911-12, rodman, Algoma Central Rly.; 1913, levelman, C.P.R., mtce. of way dept., Sudbury; 1914 (4 mos.), transitman, International Nickle Co.; 1914 (8 mos.), transitman, right of way survey, Soo Branch, C.P.R.; 1915-16, instr'man., International Nickle Co.; 1916-19, overseas levelman and transitman, Can. Rly. Troops; Aept. 1919 to date, asst. engr., P.E.P.C. of Ontario.

References: C. L. Hervey, D. Hillman, E. J. Bolger, L. E. Silcox, M. V. Sauer, B. E. Barnhill.

HILL—LIONEL COKE, of 47 Hutchison Street, Montreal, Que. Born at Derby, England, Feb. 25th, 1872; Educ., 1889-1893, time divided between office of late A. Coke Hill, Architect, Derby Technical College and private tutors; 1893-1902, dftsman., and inspection engr., Engr'g. Dept., Bass & Company, Brewers,Burton-on-Trent England; 1902-03, struct'l. designer and inspr. of work, for the late A. Coke Hill, Derby; 1903 (9 mos.), dftsman. and inspr. of bldg. constrn. in Montreal for Bell Telephone Co.; 1904-05, dftsman on concrete and steel elevator constrn., J. A. Jamieson, Grain Elevator Engineer, Montreal; 1906-07, dftsman. on similar work in United States for Macdonald Engineering Co., Chicago; 1907-08, dftsman. and designing engr., Chicago Office, John S. Metcalf Co., and to date with the same company as follows:— 1908, at Tiffin, Ont., during bldg., of G.T. Elevator; 1908-14, designing on Harbour Commissioners of Montreal and C.P.R. Elevators and other plants; 1914-19, in England, Siberia, Russia and France as European mgr., and engr.; 1919-20, in charge of company's business and constrn. of elevators at Buenos Aires, Argentine; At present special designer and representative, Montreal.

References: F. W. Cowie, J. A. Jamieson, F. L. C. Bond, E. S. Mattice, A. S. Going, H. Rolph, T. W. Harvie, E. F. Carter.

HOTCHKISS—CYRUS PERCIVAL, of 18 Broadway Avenue, Ottawa, Ont. Born at Brantford, Ont., Dec. 28th, 1891; Educ., B.Sc., Univ. of Alta., 1913, D.L.S., A.L.S.; 1910 (summer), C.P.R. irrigation, near Brooks, Alta.; 1911-12 (summers), engr'g., branch, Dept., P.W., Alta.; 1913, road constrn., City of Edmonton; 1914, asst., and 1915-16, first asst., base line surveys in northern Alberta; 1917-19, overseas. Can. Engrs.; 1919, first asst., 1920-21, chief of party, dom. land surveys, in Alberta; At present, chief of party , D.L. Surveys, Dept. of the Interior, Ottawa, Ont.

References: G. H. Herriot, F. V. Seibert, A. L. Cumming, P. E. Palmer, E. M Dennis, C. H. Taggart, G. C. Cowper.

HUGHSON—WILLIAM GEORGE, of 95 Spadina Avenue, Ottawa, Ont. Born At Niagara Falls, Ont., Oct. 5th, 1886; Educ., B.Sc. Queen's Univ. 1911; 1904(summer) rodman, city engr's. office, Niagara Falls, Ont.; 1904-07, oiler, exciter attendant, asst. electrician and high-tension transformer attendant, Can. Niag. Power Co., Niagara Falls, Ont.; 1908-09 (summers), engr. in charge of work under J.H. Jackson, C.E., O.L.S., Queen Victoria Park Comm'n; 1910-11 (summers), topog'l., Can. Geol. Survey; 1911-12, mine surveyor, Gilbert & Sparta townsite mines of the Oliver Iron Mining Co., Eveleth, Minn.; 1912 to date, in the surveys laboratory, Dept. of the Interior, Ottawa, under W. C. Way, standardizing measures of length, testing and reporting on surveying instruments, researches and special tests.

References: G. B. Dodge, W. C. Way, J. H. Jackson, T. H. Hogg, E. M. Dennis.

JARVIS—RICHARD RAYMOND, of 182 Lisgar Street, Ottawa, Ont. Born at London, England, April 19th, 1894; Educ., Great Eastern Rly. Mechanic's Institute and Westham Technical Institute, London, England.; 1908-12, dftsman., Messrs. Marks & Clerk, Chartered Patent Agents and Consltg. Engrs. During this period passed exams. in mach. [illegible], mechanics, physics and math., City and Guilds of London Institute; 1912-15, dfting and amending patent specifications in the London Offices of Marks & Clerk. [illegible] Board of Trade Cert.; 1915-19, overseas, R.F.A.; 1919-21, continued in the London Offices of Marks & Clerk, and from Sept. 1921 to date, manager, Marks & Clerk's branch office, Ottawa, Ont.

References: R. C. Berry, A. E. MacRae, J. T. Mitchell, J. F. D. Withrow, M. Wolff

JONES—JAMES DYER, of Sault Ste. Marie, Ont. Born at Castle Shannon, Penna., Nov. 6th, 1881; Educ., Pittsburg Academy; dftsman., National Tube Co., Jones & Laughlin, Illinois Steel Co., and Lackawanna Steel Co.,; 1907-10, designing engr., Minnesota Steel Co., Duluth; 1910'12, engr., M. H. Treadwell Co., Illinois; 1916-19, chief engineer, Illinois Steel Co., Gary Works, Gary, Ind.; 1912-13 and 1919 to date, with Algoma Steel Co., as follows:— 1912-14, asst. chief engr., 1914-16, chief engr., 1919-20, gen. supt., 1920 to date, general manager.

References: J. M. R. Fairbairn, K. G. Ross, B. E. Barnhill, R. S. McCormick, C. Warnock, J. W. L. Ross, W. H. Baltzell, W. J. Fuller.

KUHRING—PAUL LUDWIG, of Ottawa, Ont. Born at Toronto, Ont., Oct. 6th., 1890; Educ., completed 3rd year Arts, Univ. of N.B.; 1910-11 (summers), with C.P.R. on mtce. surveys in N.B. and Maine; 1912-13, student asst., Dept. P.W., Chatham, N.B.; 1913-20 (except from 1916-19 when overseas with C.R.T.), engr'g. clerk, chief engr's. branch, Marine Dept., Ottawa; Nov. 1920 to date, junior engr., with River St. Lawrence Ship Channel, Marine Dept., Ottawa.

References: V. F. W. Forneret, F. A. Wise, N. B. McLean, G. Stead, N. Wilson, W. P. Anderson, F. S. Jones.

LIBBY—PHILIP MASON, of Montreal, Que. Born at Gray, Me., U.S.A., July, 5th, 1896; Educ., B.S. (Forestry), Univ. of Maine, 1917. Univ. of Wisconsin, Extension Division, various courses in civil engr'g.; 1916 (summer), valuation survey for Bangor Railway and Electric Co.; 1917-18, overseas with U.S. Army; 1917 (June-Oct.), inspr. of logging operations for the Great Northern Paper Co. of Bangor, Me.; 1919-21, struc't dftsman., Riordon Co. Ltd., Mattawa, Ont.; 1921 (June-Sept.), rodman and instr'man on power slrvey for Donnacona Paper Co. Ltd.,; 1921 (Oct.-Dec.) in charge of survey party on power project for G. R. Hecjkle, of Montreal; Dec. 1921 to Feb. 1922, recorder etc. on power survey for Laurentian Power Co., Beaupre, Que.

References: G. L. Freeman, J. Ruddick, J. A. Beauchemin, L. S. Dixon, G. R. Heckle, J. R. Montague, R. de la B. Girouard.

MACDONALD—COLIN STONE, of 66 Goulburn Avenue, Ottawa, Ont. Born at Ottawa, Ont., May 26th, 1887; Educ., Private tuition, D.L.S., 1903-10, railway reconnaissance, and dom. land surveying; 1910-18, D.L.S. Asst.; 1918, overseas,Can. Engrs.; 1919, D.L.S. asst.; 1920 to date, chief of party, Dom. Land. Surveys, Ottawa.

References: A. L. Cumming, C. H. Taggart, G. H. Herriot, A. P. Deroche, E. M. Dennis.

MARSHALL—JOHN H. G., of Ottawa, Ont. Born at Stella, Ont., March 4th, 1882; Educ., B.Sc., Queen's Univ., 1908; 1901-03, machine shop, 1906-08, and college vacations dfting. and designing with the following firms, — Elwell Parker Elec. Co., Cleveland Twist Drill Co., Cleveland Street Railway Co. and Can. Westinghouse Co.; 1908, dftsman and designer on engines, Sawyer Massey Co., Hamilton, Ont.; 1909, asst. master mechanic and dftsman., Deloro Smelter; 1910, master mechanic and chief engr., Wettlauffer Mining Co., Cobalt; 1911, installing air compressor plant and in charge of mech. and elec. equipment , Diamond Coal Co., Alta.; 1912-13, mech. and elec. contracting, Calgary; 1913-15, Calgary Dept. P.W., installing and operating (in charge, power equipment; 1916 to date, patent examiner in charge of division of textile engineering and associated classes.

References: R. C. Berry, A. E. MacRae, A. W. Haddow, J. T. Mitchell, A. Langlois, W. M. Tobey, B. F. Norrish.

McCLOSKEY—MICHAEL D'ARCY, of Chelsea, Que. Born at Hull, Que., Feb. 24th, 1885; Educ., Private tuition, D.L.S., exams. 3 years articled pupil to D. L.S., 1911, 1913, 1914; 1912 (summer), dftsman, instr'man., etc., for R. W. Farley; one year technical clerk in office of Surveyor-General; 1917-18, overseas. Lieut., Can. Engrs.; 1915-16, and 1919 (July-Dec.), asst. on D.L.S.; April 1920 to date, chief of party, Topog'l. Surveys Branch, Dept. of the Interior, Ottawa, Ont.

References: E. S. Martindale, G. H. Herriot, E. M. Dennis, F. V. Seibert, P. E. Palmer, G. H. Blanchet, G. C. Cowper, A. L. Cumming.

McDOUGALL—SAMUEL G., of Ottawa, Ont. Born at Renfrew, Ont., April 30th, 1890; Educ., B.A.Sc., Univ. of Toronto, 1911; 1906-07, field dftsman., on location party and asst. to chief of sounding and testing party, N.T.C. Rly.; 1911-12, asst. to contractor's engineer on constrn., T.N.C. Rly.; prin. asst., Morris & Moore, gen. civil engr'g. practice, Pembroke, Ont.; 1914-15, supt. of constrn., Soper & McDougall, Engrs. and Contractors, Ottawa, Ont.; 1915-18, overseas. Major, Can. Rly. Troops; 1919-20, asst. designing engr. to the constlg. engr. to the Dom. Govt.; 1920 to date, in private practice as civil engineer, specializing in physical appraisal work.

References: A. L. McDougall, J. L. Morris, W. J. Moore, A. G. T.. LeFebvre, J. A. Hesketh, W. P. Wilgar, M. B. Atkinson, W. A. Duff, K. Weatherbe, W .E. Davis.

McELHANNEY—THOMAS ANDREW, of 136 Broadway Avenue, Ottawa, Ont. Born at Ripley, Ont., April 22nd, 1886; Educ., B.A.Sc. Univ. of Toronto, 1912, D.L.S., B.C.L.S.; 1907-09 (summers), topog'l. and geol. surveys; Summer 1910, chief of party, geol. surveys, Winter 1910-11, completed plans etc.; 1911, charge of sub-party for B C. Govt.; 1911-12, exploration work for B.C. Govt.; 1913-17, member of firm, McElhanney Bros.; Surveyors and Engineers, Vancouver, B.C.; 1918, with Canadian Aeroplanes Ltd. on aeroplane constrn.; 1919 to date, asst. controller of surveys, Topog'l. Surveys Branch, Dept. of the Interior, Ottawa, Ont.

References: H. L. Seymour, B. H. Segre, S. D. Farcett, F. V. Seibert, J. L. Rannie, T. H. Bartley.

McKAY—ROBERT B.,of Ottawa, Ont. Born at Cornwall, Ont., April 21st, 1883; Educ., B.Sc. Queen's Univ. 1904; D.L.S., B.C.L.S.; 1905-08, deputy mineral surveyor, Nevada; 1913 to date, surveys engineer, Topog'l. Surveys Branch, Dept. of the Interior, Ottawa, Ont.

References: E. M. Dennis, W. H. Powell, G. H. Herriot, A. L. Cumming, E. A. Neville

MEADOWS—WILLIAM WALTER, of Maple Creek, Sask. Born at St. Thomas, Ont., May 27th, 1873; Educ., Grad. S.P.S. Univ. of Toronto 1895, O.L.S. 1898; 1895-96, rodman on Mich. Central R.R. at St. Thomas; 1897 articled to J. R. Deacon, O.L.S. at Kenora; 1898, practising O.L.S., St. Thomas; 1899-1905 asst. engr. Lake Erie & Detroit River Rly., location, constrn. [illegible]; 1905-06 engr. in charge of location, [illegible] Rly. in Quebec under Mr. [illegible]; 1906 to date, [illegible] surveyor and engineer, Dept. of Highways, Regina.

References: H. S. Carpenter, M. B. Weekes, [illegible], L. W. Murray, M. H. [illegible].

MOORE—THOMAS JOHN McLUCKIE, of North Bay, Ont. Born at Glasgow, Scotland, Jan. 23rd, 1890; Educ., 1904-08, Royal Technical College, Glasgow. [illegible] ap'tice with Sir Wm. Copland, Glasgow, [illegible] engr'g works, docks and quay wall constrn. 1909-12, asst. to Sir Wm. Copland & Sons on the design, laying out, [illegible] and superintendence of constrn. of storage reservoirs, water supply schemes, etc. Also res. engr. on constrn. of sewer [illegible] under air pressure as part of [illegible] of Glasgow Main Drainage. 1912-13, instr'man. on location and constrn., C.N.O. Rly.; 1913-15, asst. engr., Man. Hydrometric Survey, 1915-19, overseas Can. Engrs. and Can. [illegible] Section. 1920-21, [illegible] engr., Man. Hydrometric Survey; 1921 to date, power development engr., Ont. Hydrometric Survey, in charge of [illegible] in Northern Ontario.

References: J. B. Challies, J. T. [illegible], [illegible], C. H. Attwood, D. L. McLean, T. B. Campbell, A. McLellan.

MORGAN—A. HEDLEY, of 204 Hyman Street, London, Ont. Born at [illegible], Monmouthshire, England, Nov. 4th, 18[illegible]; Educ., 1887-89, evening technical classes, Montreal; 1884-89 ap'tice machinist, Montreal; 1889-92, tool dept., Singer Mfg. Co.; 1892-95, in charge of dept., Pillow Hersey Mfg. Co., Montreal; 1895-1900, partner, Kerr & Morgan Mfg. Engrs., Montreal; 1900-04, sales engr. and 1904 to date, works mgr. and engr. in charge of design and manufacture, E. Leonard & Sons, London, Ont. (Member, A.S.M.E. 1919)

References: R. W. Angus, H. G. [illegible], C. A. Walker, E. I. Leonard, H. A. [illegible].

MURPHY—STEPHEN JOHN, of 438 Nelson Street, Ottawa, Ont. Born at Montreal, Que., Dec. 30th, 1893; Educ., B.Sc. McGill Univ., 1915; 1910-12 summers, dfting, blueprinting, preparing deed plans and descriptions, C.P.R., Montreal; 1913-14 with Dom. Bridge Co., Montreal, on design of bridges and bldgs., 1914 (2 mos.), asst. on design of stop log dams etc., Structural Engineering Co., Montreal; 1915 to date, Topog'l. Surveys Branch, Dept. of the Interior, Ottawa, at present in charge of Aneroid Testing Section, Surveys Laboratory.

References: W. C. Way, K. M. Cameron, R. C. Berry, F. Brown, H. M. MacKay, D. C. Tennant, P. L. Pratley.

NELSON—JAMES BARRON, of 33 Enderley Road, Toronto, Ont. Born at Glasgow ,Scotland, Sept. 2nd, 1891; Educ., Heriot Watt Technical College, 1908-11, 6 years (1905-11), pupil and junior dftsman., McKenzie & Moncur Ltd., Ironfounders and Struct'l. Engrs., Edinburgh; 1911-14, dftsman., Canada Foundry Co. Ltd., Toronto; 1915-16, asst. to works mgr., David King & Sons Ltd., Engrs., Glasgow, Scotland; 1916-19, overseas, R.F.C., Designer etc., on aerodrome constrn.; May 1919 to Dec. 1920 as follows:— 7 mos. struct'l. dfting instructor, D.S.C.R., Toronto, 6 mos. asst. constrn. engr., Goodyear Tire & Rubber Co., Toronto. 4 mos. acting chief dftsman. Canadian Allis-Chalmers Ltd., Toronto. 2 mos. checker, Dominion Bridge Co., Lachine; Dec. 1920 to date, Struct'l. designer and checker on super-structures for power houses, H.E.P.C. of Ont.

References: J. McNiven, H. V. Armstrong, A. Peden. Jr., A. F. Galea, A. L. [illegible].

PLANCHE—CLIFFORD CARLYLE, of Calgary, Alta. Born at Cookshire, Que. Jan. 1st, 1886; Educ; B.Sc. McGill Univ., 1911; 1910 (4 mos.), asst. to res. engr., on St. Lawrence Ship Canal Development; 1911 (5 mos), instr'man., Shawinigan Transmission Line Constrn.; 1911-12, charge of party doing subdivisions, street grades, prelim. street railway location etc.; 1912 (7 mos), instr'man on street paving, Vancouver; 1913-14, surveying and mapping automobile roads in Eastern Quebec; 1915-18, overseas. Lieut. Can. Rly. Troops; 1919-20, hydrometric engr. in charge of Saskatoon District, for Dom. Water Power Branch; 1921, asst. to engr. in charge of party carrying out water power surveys and investigations in Mackenzie District and in Alberta for Dom. Water Power Branch; At present junior hydrometric engr. engaged in general computations and field surveys in connection with water power and hydrometric surveys for the Dom. Water Power Branch.

References: A. L. Ford. G. H. Whyte, P. J. Jennings, R. S. L. Wilson, H. R. Cram, G. N. Houston, C. G. Child.

PRITTIE—LLOYD CONN, of Ottawa, Ont. Born at Carleton Place, Ont., Jan. 5th, 1890; Educ., B.Sc., Queen's Univ. 1912; 1910 (May-Oct.), mining, Helen Mine, Michipicoten; Field seasons 1911-12, asst. to Dr. W. H. Collins, Geol. Survey, Sudbury District; 1912-13, technical asst., computing division, topog'l. survey, Dept. of the Interior; 1913-18, junior hydrographic engr., Dept. of the Naval Service; 1918-19, Lieut., R.N.V.R., with the hydrographic dept., of the British Admiralty in the Mediterannean; 1919-20, junior hydrographic engr., Dept. of the Naval Service; April 1920 to date, asst. patent examiner, Patent and Copyright Office, Ottawa.

References: R. C. Berry, C. P. Edwards, G. B. Dodge, [illegible], A. MacPhail, A. E. MacRae, J. T. Mitchell, W. J. Stewart.

RALPH—JOHN HERBERT, of 258 Second Avenue, Ottawa, Ont. Born at Sault Ste Marie, Ont., May 19th, 1880; 1900-06, electric wireman, 1908-19, asst. chief electrician, 1919-20, acting chief electrician, and 1920 to date, electrical engineer, Department Public Works, Ottawa, Ont.

References: J. Murphy, A. A. Dion, J. F. Brown, S. J. Chapleau, D. A. Williamson.

RAMSAY—ENSLEY MOORE, of Ottawa, Ont. Born at Arnprior, Ont., Sept. 12th, 1892; Educ., I.C.S.; 1909-11, detailer, 1911-12, dftsman., Ottawa Car & Mfg. Co.; 1912-13, asst. supt., carriage dept., Ottawa, Car Co.; 1913-14, chief dftsman., Energite Explosives Co., Renfrew, [illegible]; 1916-18, checker and chief dftsman., [illegible]; designer and constrn. engr., Bate McMahon Co., Ottawa; 1918-19 designer, Foundation Co., Montreal; 1919 (5 mos.), constrn. [illegible], Montreal, 1919-20, asst. supt., [illegible], Major Wm. H. Wardwell, M.E., Montreal; 1920-21, designer, Riordon Co., Mattawa and Temiskaming, May 1921 to date, [illegible] of the Interior, Ottawa.

References: C. M. Morssen, W. H. Wardwell, [illegible], G. F. Richan, H. R. Cram, L. S. Dixon, W. C. Gillis.

SHANKS—THOMAS, of Ottawa, Ont. Born at Moose Creek, Ont., April 23rd, 1869; Educ., B.A.Sc., Univ. of Toronto, 1900, D.L.S. 1902; 1899 (summer), dftsman. New Jersey Steel & Iron Works, Trenton, N.J., and 1 month asst. to T. H. Wiggins, O.L.S., munic. engr'g.; 1900, asst. to A. O. Wheeler, D.L.S., photo. topog'l. survey at Crow's Nest Pass, 1901, asst. to [illegible], D.L.S. 1901 to date, Topographical Surveys Branch, Dept. of the Interior, [illegible] asst. chief dftsman, and in 1911 on [illegible] position. 1914, Order-in-Council passed designating position as Asst. Surveyor General. Feb. 1921 to date as Acting Surveyor General in charge of Topog'l. Surveys Branch.

References; G. A. Mountain, J. White, C. H. Mitchell, J. B. Challies, D. W. McLachlan, N. J. Ogilvie, O. S. Finnie, G. B. Dodge.

TURNER—JOHN HARRISON, of Coalhurst, Alta. Born at Liverpool, England, in 1863; Educ., Student of engineering at University College and City and Guilds College, London, England. 1879-1883, pupil and asst. to the late Sir W. E. Garforth, developing and fitting up coal mines in England; 1883-84, surveying and asst. mgr. of the Massarelos Foundry, Oporto, Portugal; 1883-91, designing and erecting pumping engines for Kimberley waterworks, South Africa, [illegible] car lines in Birmingham, Bristol, Northfleet and other towns, Port and Pier Ry., Bristol, The South Yorkshire Ry., the Barranquilla & Boyata Ry., and Landing Pier, Columbia, South Africa, Concrete Dam 120 ft. high for the Tytam Reservoir, Hong Kong waterworks, also as consltg. engr. designing promenade and other iron piers for France, Belgium and South America, constructing wharf bldgs. and installing plant for ice making, grain cleaning and pumping at Bushire, Persia, erecting bldgs. and installing plant for a large lumber mill at Peterboro, England; 1891-1904, res. engr., in charge of constrn. of four power stations and asst. supt. and supt. of the London Hydraulic Power Co., England; 1904-10, owner and mgr. of the Wiltshire Foundry, Manufacturing Oil and Gas Engines, agric. machinery, water and sewage plants; 1910-15, contracting in Alta. and Sask., bridges, sewages and waterworks; 1915-17, prospecting and developing minerals claims, west of Banff; 1917 to Jan. 1922, mine engr., and surveyor at North American Collieries Mine at Coalhurst, Alta.

References: W. Chipman, G. H. Power, C. M. Arnold, P. M. Sauder, J. Haddin, B. L. Thorne, E. L. Miles.

UNDERHILL—GEORGE GARDNER, of Montreal, Que. Born at Albany, N.Y., U.S.A., June 7th, 1884; Educ., C. E. Cornell Univ., 1906; Worked in minor capacities on mtce. of way staff, N.Y.C.R.R. also on bridge and dock work in Penn. R.R. tunnel and on compressed air work; In 1908 became supt. for Mackenzie Mann & Co., at Montorrey, Mexico, on tunnel work, excavation and reinforced concrete. In 1909 went to Puebla for E. V. Foster as Manager for their municipal constrn. contracts. In 1911 went to Santa Rosalia as gen supt. of constrn. of hydro-electric development for Mexico Northern Power Co., remaining there until the spring of 1916, the last two years in complete charge of this work, with title of chief engr., and supt. of constrn. On leaving Mexico came to Fraser Brace Ltd., as a constrn. manager, and at present a director and manager of this company.

References: J. H. Hunter, C. E. Fraser, J. H. Brace, J. C. Smith, S. Svenningson.

WAUGH—BRUCE WALLACE, of Ottawa, Ont. Born at Logan Township, Perth Co., Ont., Mar 24th, 1888; B.A.Sc. Univ. of Toronto, 1908, D.L.S. 1912; 1908-09, inspr. of raw material, Western Electric Co., Chicago; 1909-12, articled pupil, and at present on returns of survey of summer 1921, Topog'l. Surveys Branch, Dept. of the Interior, Ottawa, Ont.

References: F. V. Seibert, G. H. Herriot, A. L. Cummings, S. D. Fawcett, G. C. Cowper, P. E. Palmer.

WRONG—FREDERICK HAY, of Ottawa, Ont. Born at Chatham, Ont., Aug. 22nd, 1886; Educ., B.A.Sc., Univ. of Toronto, 1912, 1910 dftsman on constrn. work, Trussed Concrete Steel Co., Detroit, Mich.; 1911, asst. on O.L.S., for J. H. Beatty, O.L.S., also on prelim. survey for install'n. of water and sewage system at Timmins, Ont., for Routly, Summers & Malcomson, Haileybury, Ont.; 1912 to date, asst. D.L.S., Topog'l. Surveys Branch, Dept. of the Interior, Ottawa, Ont

References: E. M. Dennis, F. V. Seibert, E. P. Bowman, W. H. Norrish, S. D. Fawcett.

FOR TRANSFER FROM CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

BERRY—ROBERT CRAPPER, of 54 The Driveway, Ottawa, Ont. Born at Bury, Lancashire, England, Nov. 1st, 1891; Educ., B.Sc., McGill Univ. 1913; 1910 (5 mos), location party, G.T.P.; 1911 (5 mos), topog'r., C.P.R.; 1912 (5 mos), asst. engr., mtce. of way, C.P.R. Farnham; 1913-15, with the C.P.R. as follows:— 1913-14, asst. engr., C.P.R. Terminals, Montreal; 1914 (9 mos), asst. engr., Quebec Freight Constrn.; 1914-15, local supt., revision of ventilation plant, C.P.R. Bldg., Toronto; 1915 (4 mo), local supt., steel fire door constrn. for Chateau Frontenac, Quebec; 1915 to date, examiner in responsible charge of the scientific and geometrical instrument division of the Canada Patent Office, Ottawa, Ont.

References: K. M. Cameron, J. B. McRae, A. E. MacRae, R. A. C. Henry, L. G. Denis, A. Ferguson.

BUCKE—WILLIAM A. 212 King Street West, Toronto, Ont. Born at Sarnia, Ont., April 12th, 1873; Educ., B.A.Sc., Univ. of Toronto, 1895; 1896-1912, testing, Constrn. and sales engr'g. work; 1912-19, district manager, Can. Gen. Elec. Co., Toronto, and manager, apparatus sales dept., to date.

References: J. M. R. Fairbairn, W. J. Francis, J. M. Robertson, H. G. Acres, E. L. Cousins, K. B. Thornton, R. M. Wilson.

CAMERON—JOSEPH GEORGE, of Cornwall, Ont. Born at Finch, Ont., May 2nd, 1890; Educ., B.Sc. Queen's Univ. 1914; 1911-13 (summers), asst. to Magwood & Stidwell, Consltg. Engrs., Cornwall; 1914-16, mgr. of firm, Cameron Bros., Contractors and Engrs., constructing munic. drains, concrete culverts and bridges; 1917 to date, county engr., under the "Highways Improvements Act" for the united counties of Stormont, Dundas & Glengarry.

References: W. H. Magwood, R. C. Muir, H. T. Routly, F. G. Bird, F. Stidwell, J. B. Wilkinson.

CARPENTER—HENRY S., of Regina, Sask., Born at Collingwood, Ont., Feb. 8th, 1874; Educ., B.A.Sc., Univ. of Toronto, 1898; D.L.S., S.L.S., O.L.S.; 1899, practising as O.L.S., Collingwood, Ont.; 1900, asst. engr., Dept. of Rlys. and Canals on Yukon rly. exploration; 1901-05, asst. engr. on constrn. Trent Canal, Peterborough and Gamebridge, Ont.; 1905 to date, with Sask. Govt. as follows:—1905-06, district engr., and surveyor, Dept. Public Works; 1907-08, director of surveys; 1909-10, supt. of highways, Dept. Public Works; 1911-12, acting deputy minister and chief engr., Dept. Public Works; 1913-14, supt. of highways with Board of Highway Commissioners; 1915-17, acting-chairman, Board of Highway Commissioners; 1917 to date, deputy minister and chief engr., dept. of highways.

References: W. J. Francis, L. A. Thornton, A. J. MacPherson, J. R. C. Macredie, C. W. Dill, H. R. MacKenzie.

CONNOR—ARTHUR WILLIAM, of 34 Victoria Street, Toronto, Ont. Born at Renfrew, Ont., Oct. 14th, 1870; Educ., B.A. 1893, C.E., 1900, Univ. of Toronto; 1895, 1897-1902, with Hamilton Bridge Works, detailing and designing struct'l. steel work, highway and railway bridge work; 1896-97, similar work with central Bridge Works, Peterborough; 1902-05, similar work with Canada Foundry Co. Ltd., Toronto; 1905 to date, consltg. and supervising struct'l. engineer in Toronto. Acting as bridge and road engineer for about six counties and many townships.

References: W. J. Francis, P. Gillespie, A. H. Harkness, A. L. Mudge, J. M. Oxley, C. H. Mitchell, R. K. Palmer, J. N. Smith.

HOGG—THOMAS H., of 117 Normandy Boulevard, Toronto, Ont. Born at Chippawa, Ont., April 20th, 1880; Educ., B.A.Sc., (C.E.), Univ. of Toronto, 1907; Member, A.S.C.E.; 1902-11, with Ontario Power Co., Niagara Falls, in minor capacities; 1911-12, Editor, Canadian Engineer; 1912 to date, asst. hydraulic engr. H.E. P.C. of Ontario in charge of design and constrn. of all hydraulic work of the hydro-electric power plants of the commission. At pressnt acting hydraulic engr.

References: H. G. Acres, C. H. Mitchell, W. J. Francis, A. C. D. Blanchard, R. S. Lea, N. R. Gibson, F. A. Gaby.

MACKENZIE—ALLAN CAMPBELL, of Montreal, Que. Born at Inverness, Scotland, April 19th, 1881,; Educ., Inverness Borough Technical School; 1901-03, asst. engr., with consltg. engr. in general practice; 1903 to date, with C.P.R. as follows:—1903-05,dftsman., instr'man. and asst. res. engr. on mtce.; 1905-07 res. engr. on constrn. 1907-09, res. engr. on mtce.; 1909-11, asst. engr., mtce. of way, Eastern Lines; 1917-19, engr., mtce. of way, Western Lines; 1911-17, and 1919 to date, engr., mtce. of way, Eastern Lines.

References: J. M. R. Fairbairn, J. G. Sullivan, H. H. Vaughan, G. A. Mountain, C. N. Monsarrat.

MACKINNON—GEORGE DOUGLAS, of Sherbrooke, Que. Born at Charlottetown, P.E.I., June 8th, 1874; Educ., B.A.Sc., McGill Univ. 1897; 1898-99, engr'g. and contracting, sewerage constrn., Charlottetown, P.E.I.; 1899-1904, engr'g. with the following firms, Ball & Wood, Engine Co., Elizabethport, N.J., C. Corrie & Sons, Newark, N.J., Midvale Steel Co., Philadelphia; 1904-09, in charge plate dept., Jenckes Machine Co. Ltd., Sherbrooke, Que.; 1909, formed company MacKinnon Holmes & Co. Ltd., reincorporated 1917, MacKinnon Steel Co. Ltd. Vice-President and Managing Director from 1909 to date, engaged in the fabrication and erection of steel bridges, bldgs., penstocks, tanks, etc.

References: W. J. Francis, F. B. Brown, J. T. Farmer, W. S. Lea, G. R. MacLeod.

RANKIN—JOHN, of Ottawa, Ont. Born at Montreal, Que., Oct. 24th, 1870; Educ., B.A.Sc.,McGill Univ. 1894, 1890-93, rodman, leveller and transitman on hydrographic and rly. surveys; 1894-96, in the employ of J. M. Shanley and of J. N. Patton, Q.L.S.; 1897-1900, with R. W. Hildred & Co., Consltg. Engr., New York, mill and shop inspection, street rly. constrn. and bldg. constrn.; 1901, with Ralph Modjeski, Chicago, in charge of fabrication of steel work and manufacture of machinery for the Lake Superior Power Co., Sault Ste Marie, Ont.; 1902-03, asst. to W. J. Francis, fabrication of steel work and manufacture of machinery for hydraulic locks Nos. 1 and 2, Trent Canal, and res. engr. on erection of these locks; 1907-14, inspection work on bridge erection, C.P.R.; 1915-18, res. engr., Quebec bridge, Board of engineers; 1919, inspecting engr., Bridge work, C.N.R.; 1920, inspecting engr., bridge work, Grand Trunk Arbitration.

References: W. J. Francis, P. B. Motley, C. N. Monsarrat, G. F. Porter, A. F Stewart, R. A. C. Henry.

SUTHERLAND—WILLIAM H., of 384 Grosvernor Avenue, Westmount, Que. Born at Toronto, Ont., Aug. 28th, 1879; Educ., B.A.Sc., Univ. of Toronto, 1903; 1903-04, dftsman., engr'g. dept. Bell Telephone Co., Montreal; 1904-05, dftsman., and 1905 to date, asst. engr., Montreal Water & Power Co., Montreal.

References: F. H. Pitcher, W. J. Francis, R. A. Ross, W. G. Chace, H. G. Hunter, R. M. Wilson.

TROTTER—HAROLD L., of St. Johns, Que. Born at Montreal, Que., Jan. 29th, 1883; Educ., Grad. R.M.C. Kingston, 1903; 1903-11, with Ross & Holgate, Engineers; 1911-15, with Henry Holgate as associate; 1915-18, overseas, Can. Engrs., Lt.-Col., D.S.O.; 1919, in charge of road contract, Mount Revelstoke; 1920-21, chief engr. for Morrow & Beatty, Contractors, Peterboro, Ont., on constrn. of hydro-electric plant at Twin Falls on the Abitibi River.

References: G. G. Gale, H. Holgate, R. A. Ross, W. J. Francis, F. B. Brown, J. A. Beatty, C. L. Cate.

WINTERROWD—WILLIAM HOLLAND, of 149 Marlowe Avenue, Montreal, Que. Born at Hope, Indiana, U.S.A., April 24th, 1884; B.S.M.E. Purdue Univ., 1907; 1905, blacksmith helper, Lake Erie and Western Rly.; 1906, car and air brake repairman, Penna. R.R.; 1907, special ap'tice, 1908-10, roundhouse foreman, 1911, asst. engr., Lake Shore and Michigan Southern Rly.; 1912-15, mech. engr., 1915-18, asst. to chief mech engr., and 1918 to date, chief mech. engr., C.P.R., Montreal.

References: W. J. Francis, H. H. Vaughan, H. Holgate, J. M. R. Fairbairn, J. W. Orrock, F. S. Keith.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

ADAMS—WILLIAM DOUGLAS, of 77 Dunn Avenue, Toronto, Ont. Born at St. John, N.B., Aug. 3rd, 1887; Educ., Grad. R. M. C. Kingston, 1908; 1906 (summer) with Messrs. Speight & Van Nostrand and 1907 (summer), instr'man. with same firm; 1909 (June-Nov.), asst. engr., middle divn. G.T.R.,; 1909-10, in charge of engr'g. dept., Canadian Buffalo Forge Co., Montreal; 1910-14, asst. engr., grade separation, rly. and bridges section, Dept. of Works, City of Toronto; 1914-19, overseas. Major, awarded M.C.,; 1919 (Feb.-Sept.), asst. engr. Rly. and bridge dept., Dept. of Works, City of Toronto; 1919-21, partner, Adams Bros., Toronto, Engr'g. Equipment; Jan. 1921 to date, asst. engr. with Toronto Transportation Commission, Toronto.

References: J. R. W. Ambrose, H. J. Lamb, E. L. Cousins, B. Ripley, E. G. Hewson.

BOURGET—PAUL BLAGDON, of 425 Daly Avenue, Ottawa, Ont. Born at Regina, Sask., Jan. 9th, 1895; Educ., Ottawa Collegiate Institute. Private tuition. I.C.S.; 1911, on govt. surveys; 1912-13, rodman, 1914, acting instr'man., 1914-15, asst. to res. engr. at Colborne, Ont., C.P.R.; 1915, mech. dfting. and design, Dept. P.W., Victoria Shipyards, Ottawa; 1916, in charge of dfting. dept., Victoria Shipyards, Ottawa,; 1916-19, overseas, Lieut. Can. Engrs.; 1919-20, in charge of bridge constrn., Canada Engr'g. and Constrn. Co., and Ontario Bridge Co.; 1920 to date, (on account of scarcity of engr'g. work, loans officer, D.S.C.R., Ottawa. Engr'g. work during spare time and holidays for townships of Clarence, Cambridge, Lochaher and Gore.

References: W. H. McGaan, D. G. Kilburn, J. E. N. Cauchon, J. E. Larochelle.

CROUCH—WILLIAM WESLEY, Jr., 728 Woodlawn Place, Mexico, Missouri, U.S.A. Born at Sharon, Pa., U.S.A., Nov. 22nd, 1891; Educ., B.C.E. Univ. of Manitoba, 1916; 1913-15 (summers), asst. on drainage work for Man. Public Works Dept.; 1916 (summer), asst. to McColl Bros., Land Surveyors, Winnipeg; 1917-18, res. engr., Winnipeg Aqueduct Constrn. Co.; 1919, instr'man. C.N.R. on constrn. at Eston, Sask.; 1920 to date, res. engr. for Black and Veatch, Consltg. Engrs., of Kansas City, at present on constrn. of sewage disposal plant, Mexico, Missouri.

References: E. E. Brydone—Jack, W. Smaill, A. H. Corbett, D. E. McPherson, R. W. Moffatt, D. L. McLean, W. G. Mawhinney.

deVALTER—ROGER AUDOIR, of Quebec, Que. Born at Arcadon, France, Sept. 5th, 1890; Educ., Ecole Condorcet, France, 1907. 2 years course, Institut Electrotechnique de Paris, France. Technical and Industrial School, Sherbrooke College, 1909; 1908-09, in charge of meteorological service, St. Chs. Seminary, Sherbrooke; 1909 (summer), transitman, Brompton City Survey, a survey on proposed line of the Sherbrooke-Kenebec Rld.; 1909-11, dftsman. and asst. of Mr. J. O'C. Mignault, C.E. on various engr'g. works and surveys; 1911-14, 5 mos. dftsman., and later asst. engr., under K. M. Cameron and afterwards under A. G. Sabourin, Department Public Works of Canada; Aug. 1914, reported to French Military authorities for active service; 1917-20. in charge of dredging operations and making report to the district engr., and May 1921 to date, junior engr., district of Quebec, Department Public Work Canada.

References: K. M. Cameron, A. G. Sabourin, C. J. Desbaillets, J. K. Laflamme, L. A. Dubreuil, L. N. Boulet, G. L. Hall.

ENGLISH—WILLIAM CAMPBELL of Peterborough, Ont. Born at Peterborough, Ont.; Aug. 31st, 1892; 1907-11,a'p'ticeship, mech. dept., C.G.E. Co., Peterborough; 1911-13, in same dept.; 1914-15, mech. dfting., De Laval Co., Peterborough, Ont.; 1915-16, mech. dfting., Ross Rifle Co., Quebec; 1916 to date, asst. in charge of design of tools for induction motors and meters under J. A. G. Goulet, mech. dept., C.G.E. Co., Peterborough, Ont.

References: J. A. G. Goulet, C. E. Sisson, R. L. Dobbin, B. L. Barns, J. Barnes, A. B. Gates.

JOHNSTON—BRUCE ALEXANDER, of 189 Kennedy Street, Winnipeg, Man. Born at Melita, Man., Sept. 15th, 1891; Educ., B.C.E. Univ. of Man. 1915; 1912-14, dftsman., C.N.R. Bridge Dept., Winnipeg; 1914 (5 mos.), rodman, Dom. Govt. [illegible] asst. engr. bridge design, C.N.R. [illegible] asst. engr., [illegible] Board, Manitoba; 1916-19, overseas; [illegible] 1919-20, asst. engr. bridge dept., C.N.R. Winnipeg; 1920 to date, bridge engr., Good Roads Board, Manitoba.

References: G. L. Guy, M. A. Lyons, P. Burke-Gaffney, H. R. Urie, E. S. Kent, H. S. [illegible]

JOHNSTON—GEORGE WILLIAM FREDERICK, of Chatham, Ont. Born at Lethbridge, Alta., Oct. 27th, 1893; Educ., B.A.Sc. Univ. of Toronto, 1915; 1912 (summer), rodman, City of Lethbridge, 1913-14 (summers), estimator and instr'man., roadway dept., City of Toronto; 1915-17, astronomical computer, Dominion Observatory, Ottawa; 1917-19, overseas, C.F.A.; 1919-20, astronomical computer and junior seismologist, Dominion Observatory, Ottawa; 1920-21, tank and tower dept., Pittsburgh Des Moines Steel Co., Pittsburgh, Pa., April 1921 to date, contracting engr., Canadian Des Moines Steel Co., Ltd., Chatham, Ont.

References: C. S. Boyd, E. L. Pettingill, E. D. W. Courtice, G. A. McCubbin, W. M. Tobey, G. C. Wright, J. E. Porter, C. Raley.

SCHOFIELD—STEWART, of 577 Beresford Avenue, Winnipeg, Man. Born at Monaghan, Ireland, Aug. 25th, 1887; Educ., Matric. and 1st year Arts; B.C.L.S. 1914; 1905-06, rodman, 1906-08, dftsman. and transitman, C.P.R.; 1908-10, dftsman. and transitman, Pacific Great Eastern Rly., B.C.; 1911-14, under articles of ap'ticeship to B.C. Land Surveyor; 1914-15, in charge of concrete work in engine houses and turntables, also water supply and sewerage, C.N.R.; 1915-18, overseas; 1918-19, valuation engr. of the Minnesota and Manitoba Rly., for the C.N.R.; July 1919 to date, engr. in architect's office, C.N.R. Winnipeg.

References: E. N. Johnson, J. W. Porter, H. A. Dixon, A. V. Redmond, J. N. Davidson, G. M. Pearston, W. Walkden.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

ALLEN—GERALD NICHOLSON, of 38 Botsford Street, Moncton, N.B. Born at Moncton, N.B. Dec. 23rd, 1900; Educ., 1 year N.S. Tech. Coll.; 1917 (July-Dec.), chief engr's. office C.N.R., Moncton; 1917-18, asst. chief engr's. office, Halifax Ocean Terminals, Halifax, N.S.; 1918 to date, rodman on constrn., concrete inspr., leveller, C.N.R. At present rodman on constrn. new yard and engine facilities, Moncton, C.N.R.

References: C. B. Brown, W. A. Duff, F. B. Tapley, S. B. Wass, H. L. Currie, M. J. Murphy, E. G. Evans, E. R. Evans.

FULTZ—STEPHEN LLOYD, of 170 Queen Street, Halifax, N.S. Born at Sackville, N.B., Oct. 15th, 1894; Educ., B.Sc., (C.E.), N.S. Tech. Coll, 1920; 1914 (summer), rodman, N.S. Highways; 1915 (summer), inspr., and instr'man. Halifax Terminals; 1916 (summer), inspr. and dftsman., N.S. Tramways and Power Co.; 1916-19, overseas; 1920 (May-Nov.), supervisor of steel reinforcing on New Westminster Apt. Bldg. at Halifax, N.S.; Nov. 1920 to Nov. 1921, chief of survey party on storage lakes and dam sites, and from Nov. 1921 to date, res. engr. and asst. supt. on constrn. of storage dams at Five Mile Lake, for Nova Scotia Power Commission.

References: H. S. Johnston, F. R. Faulkner, I. P. MacNab, W. G. Hardy, H. K. Smith, R. P. Freeman, H. W. L. Doane.

GRANGE—EDWARD ROCHFORT, of Ottawa, Ont. Born at Lansing, Mich. U.S.A., Jan. 11th, 1892; Educ., B.A.Sc., Univ. of Toronto, 1915; Passed prelim. exam. for D.L.S. 1911; 1909 (2 mos.), tower assembler, 1910 (3 mos.), fireman, H.E.P.C.; 1911 (3 mos.), rodman, dept. of bridges and docks, City of Toronto; 1911 (3 mos.), inspr., Toronto Hydro System; 1912 (3 mos.), balancing harbour surveys, Toronto Harbour Comm'n.; 1912 (Aug.), dftsman., Toronto Niagara Power Co.; 1912 (Sept.), timekeeper and material man on concrete street paving in North Toronto, Clarke & Monds, Contractors; 1913 (3 mos.), rodman, C.N.R., constrn., (2 mos.), instr'man., Dept. of roads, City of Toronto; 1914 (Apr.-Nov.), asst. on D.L.S. work; 1916-19, overseas. Flt. Lieut. and Capt., R.N.A.S. and R.A.F. Awarded D.S.C. and Croix de Guerre; At present, Air Certificate Examiner for the Air Board, Ottawa, Ont.

References: R. P. Johnson, P. Gillespie, C. R. Young, J. R. Cockburn, W. J. Smither, P. M. Thompson, N. D. Wilson, E. W. Stedman.

MALONE—CHARLES EDMUND, of 131 Union Street, Kingston, Ont. Born at Englewood, Ont., Jan. 17th, 1898; Educ., At present 4th year Student, Science, Queen's Univ.; 2 years, instr'man., City of Regina; 1915-19, overseas.

References: D. A. R. McCannel, W. P. Wilgar, D. S. Ellis, W. L. Malcolm, L. M. Arkley.

PATERSON—DAVID ROY, of 95 South Water Street, Galt, Ont. Born at Sydenham, Kent, England, Aug. 1st, 1895; Educ. 2 years civil engr'g., Queen's Univ.; 3 seasons 1915, 1919-20, articled pupil on D.L.S.; 1916-19, overseas; 1919-20, rodman on H.E.P.C., radial location ssrveys; Dec. 1920 to date, asst. city engr., Galt, Ont.

References: D. T. Black, C. M. Walker, L. W. Gill, E. Duncan, J. E. Jackson, F. H. Midgley.

PEARSON—CHARLES, of La Romana, SantoDomingo. Born at Hamilton, Ont., Dec. 4th, 1894; Educ., Hamilton Collegiate Institute and Hamilton Technical School; 1911-12, with E. G. Barrow, O.L.S., Hamilton, Ont.; 1912-14, rodman, levelman and dftsman on roadway and sidewalk constrn., and land surveys, City Engr's. office, Hamilton, Ont.; 1914-17, transitman and dftsman. on sewer constrn. and design in same office; 1918 (3 mos.), dftsman., Dom. Foundries & Steel Co., Hamilton, Ont.; 1918-20, res. engr. on sewer constrn. and asst. to sewer engr., City Engr's. office, Hamilton, Ont.; Nov. 1920 to date, constrn. engr. on rly. constrn. and last six months in charge of bridge erection, South Porto Rico Sugar Co., Central Romana Inc., La Romana, Santo Domingo.

References: E. R. Gray, W. M. Johnston, E. B. Allen, J. J. MacKay, W. W. Perrie, A. F. Macallum, W. Hollingworth.

STARK—WILLIAM HARDY, of Niagara Falls, Ont. Born at Toronto, Ont., Sept. 3rd, 1893; Educ., B.A.Sc., Univ. of Toronto, 1916; 1912-13, rodman etc., City of Toronto; 1914-15, rodman and instr'man., Toronto Harbour Commission; 1917-19, overseas, C.F.A.; 1919 (3 mos.), instr'man., City of Toronto; 1919-21, in charge, section of physical laboratory, Dunlop Rubber Co., Toronto; 1921, instr'man., H.E.P.C. of Ont. At present, instr'man., Niagara Falls Power Co., Niagara Falls, N.Y.

References: J. B. Goodwin, S. W. Johnston, C. A. Scott, I. F. Willsie, P. Gillespie.

Institute Committees for 1922

FINANCE

R. A. ROSS, Chairman
H. H. VAUGHAN
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High Frequency Telephone as applied to High Tension Power Stations

Experience of Shawinigan Water and Power Company in applying radio methods to telephony over power circuits.

A. S. Runciman, A.M.E.I.C.

Paper read before Peterborough Branch, The Engineering Institute of Canada, April 20th, 1922.

This is particularly a year in history for wireless telephony because it may be said that this year, or rather this winter, wireless telephones have commenced to cause the return of some of the money spent in the enormous amount of research and development work. The telephone concerts broadcasted every night by the Westinghouse Company, Radio Corporation and Marconi Company, in Canada, have resulted in a sale of enormous quantities of receiving apparatus. It is actually possible to set up in homes in Ontario and Quebec a simple receiving set which will bring in the concerts from Pittsburg and New York not every night but very often during the winter nights. It is not possible to receive a good concert every night as the distance is rather too much for the power of the transmitting sets in use. As the weather becomes warmer, increasing difficulty is always experienced in receiving very distant stations on account of the increased ratio of atmospherics to signal current. However, from the press reports, this has been a great winter for the wireless apparatus manufacturers and retailers.

It may be said that the development of the modern high frequency telephone commenced in 1906 when Dr. Lee DeForest, brought out the vacuum tube device containing three elements. This device has been described in many publications including the A.I.E.E., transactions, also the proceedings of the Institute of Radio Engineers.

The Valve

The Thermionic valve is the foundation of all present day wireless telephone apparatus and it will be described briefly with its adaptation in a present day high frequency telephone.

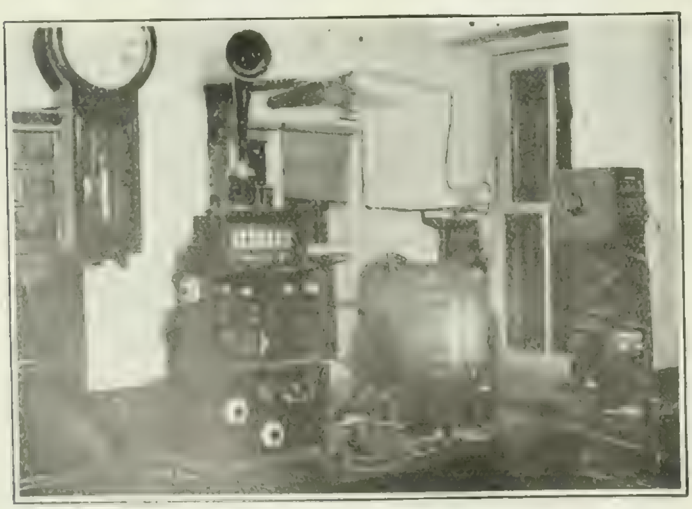
The valve consists of a hot filament or cathode, a fine wire grid control member and the plate or anode in a glass container highly evacuated. The vacuum of a good hard valve is a few ten millionths of a millimetre of mercury so for all practical purposes it is perfect. In order that it may remain a perfect vacuum the parts have all to be treated by heat before sealing to extract any occluded

gases which may be locked up in the metals and which would work out in time.

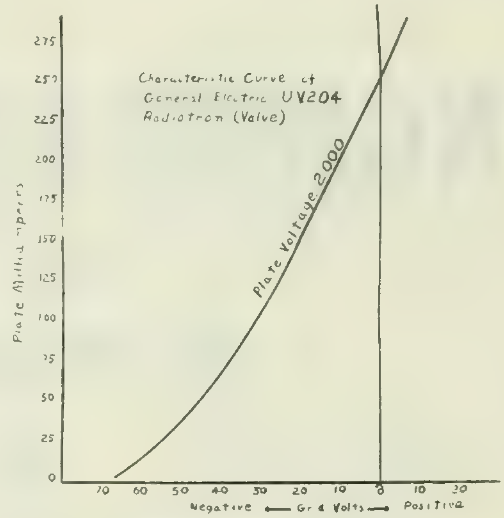
In operation the filament is heated to incandescence (2500°-2700° absolute temp.) with the result that electrons are emitted. This is the Edison effect. A battery connected between this electrode as cathode and the plate as anode produces a convection current of electrons from one to the other. Since negative electricity only is present, current can only flow in one direction, from the plate to the filament. The action so far is the same as the English Fleming valve, which also makes use of the Edison effect, but in the three element vacuum tube an epoch making advance was made in that the third electrode allows us to control the electron current completely without consuming appreciable energy at that electrode or in its circuit. In other words an inappreciable amount of power applied to the third electrode or grid will result in large changes in power in the anode circuit. Moreover since the electrons have no appreciable inertia, the response in the anode circuit to slight variations of power in the grid circuit is practically instantaneous.

To get an idea of the operation of the valve, let us examine a typical characteristic curve. This particular curve, Fig. 1, was plotted for the General Electric Company's 250 watt power valve U.V. 204. The base line represents grid potential with respect to the filament. The vertical represents the corresponding anode current in milliamperes with anode positive 2000 volts to the filament.

Note for instance with 10 volts negative grid potential the current is 205 milliamperes. Now with 30 volts negative grid potential the plate current is reduced to 105 milliamperes which, as the anode voltage remains 2000 volts, means a power reduction of nearly 50%. The power absorbed by the grid is practically nil so we may by a suitable step-up transformer transform voice controlled current to a voltage swing of 20 volts and in this case vary our power through the valve anode by 50%. This is only an example, it is possible by applying 65 volts negative potential to reduce the anode power to practically zero, thus the variation would be 100%.



Shawinigan Water and Power Company's
High Frequency Telephone Set at Shawinigan Falls, Que,



Characteristic Curve for 250-Watt power valve U. V. 204.
Fig. 1.

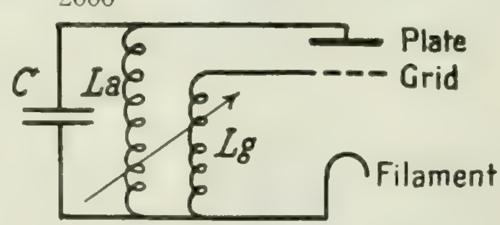
Now if we couple between the grid and filament a valve varying potential we see that the power applied between the anode and hot cathode is varied accordingly. Since the electrons have no appreciable inertia and the response is instantaneous in the power circuit it does not matter what frequency we apply it is faithfully reproduced in the power circuit with amplitude varying according to the amplitude of the source applied to the grid. It is a well known law that any amplifying device may be made to oscillate by merely feeding a small quantity of the amplified power to the control member. Therefore, by means of a feeding back connection we may apply power from the anode circuit to the grid circuit and set up the oscillations at any frequency for which we chose to design a circuit.

$$f \quad (\text{frequency}) = \frac{159{,}200}{\sqrt{L \text{ (microhenries x } C \text{ (microfarads)}}}$$

That is, by choosing capacities and inductances of suitable values we fix the frequency at which our circuit will oscillate.

In order not to be confused by the term "wavelength", it is sufficient to say that the wavelength is the distance between the crests of two adjacent waves. The total number of waves per second multiplied by the wavelength must equal 300,000,000 metres which is the distance a wave travels in one second and is the speed of light.

Thus 2000 metres wavelength is merely another way of saying $\frac{300{,}000{,}000}{2000} = 150{,}000$ cycles



Simple Oscillation Circuit
FIG. 2

Oscillator

The circuit shown in Fig. 2 consists of a three electrode valve, a tuned circuit and a feed back inductance Lg coupled to the tuned circuit inductance. Suppose we wish to design a circuit for 2000 metres or 150,000 cycles we may select either the inductance or capacity. If we select an inductance of 300 microhenries and apply this value to the formulae

$$f = \frac{159.200}{\sqrt{L \text{ (microhenry)} \times C \text{ (microfarad)}}}$$

$$150{,}000 = \frac{159{,}200}{\sqrt{300 \times C}}$$

$$300\,C = \left(\frac{159{,}200}{150{,}000}\right)^2$$

$$C = \frac{\left(\frac{159{,}200}{150{,}000}\right)^2}{300} = \frac{1.125}{300} = 0.00375 \text{ microfarads.}$$

Therefore, with our inductance of 300 microhenries in parallel with a capacity of 0.00375 microfarads and negligible resistance, we have a circuit which will oscillate at 150,000 cycles or a wavelength of 2000 metres.

We assumed a value of 300 microhenries. This inductance is made up of the inductance of coil L_a and mutual inductance of coil L_a with coil L_g. We require one variable factor in order to adjust the frequency to an exact value so either the inductance or the capacity is made variable. In a simple set the capacity C, may represent the aerial in which case it is fixed and must be measured or calculated and the formula above used to calculate the inductance. The inductance L_g as a rule is about the same as, or greater than L_a and made to vary electromagnetically with L_a. The function of L_g as stated before is to feed energy enough back to the control member, the grid, to keep the circuit oscillating. In the case of a valve of low amplification constant L_g will be considerably greater than in the case of a valve of high amplyfing ability.

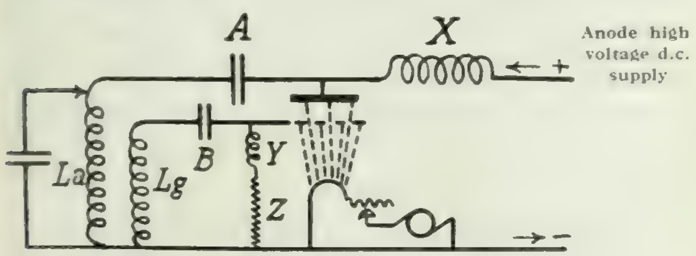
Power Supply

We have made no provision for supplying power to the valve in Fig. 2. A few remarks here with regard to separating a.c. and d.c. circuits will be of value. If the inductance is sufficiently high with regard to the frequency, a.c. will pass through a condenser through and not a choke coil. On the other hand d.c. will pass through a choke coil and is blocked by a condenser. We may, therefore insert choke coils and condensers of values greater than those used in the oscillating circuits and apply d.c. where required and isolate a.c. where we desire it.

In the oscillating circuit we have chosen in Fig. 2, it only remains to fit in the d.c. with regard to utility in the apparatus.

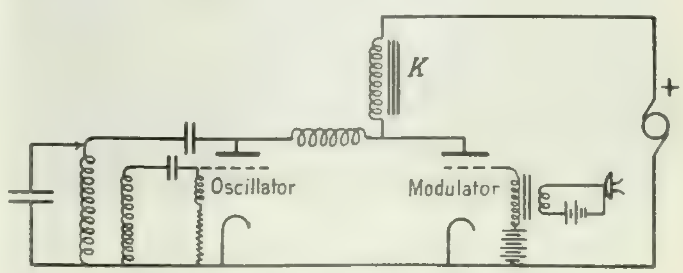
The high frequency a.c. circuit is the same as Fig. 2 with the condenser A. inserted to stop the flow of d.c. through the inductance L_a, thus the only path for the d.c. is through the valve on the electron stream from the filament. Choke coil X stops the high frequency a.c. from backing up into the machine circuit.

Now we come to the grid potential. It will be remembered referring to curve Fig. 1, that in order to limit the anode current we maintain a negative potential on the grid and the more negative the grid the less anode current flows. In order to have a base line or starting point for the varying control potential on the grid we must fix on some value to vary about. In Fig. 1, if we choose to work between 100 and 200 milliamps, the corresponding grid potentials are 30 and 10 volts negative. Therefore, if we hold the base potential at 20 volts negative and allow the control to swing on either side of 20 volts we will have a good average control. In order to hold this 20 volts, we may use a battery usually termed a "C" battery or still better a grid condenser "B" and grid leak resistance Z (Fig. 3). The a.c. passes through the condenser B. and as only negative electricity is emitted from the filament the positive half cycle flows in to the filament. The negative half cycle is trapped on the grid and the grid side of the grid condenser. With the circuit oscillating this negative potential will build up to such a value that the anode current will be reduced to zero. Instead of allowing this a choke Y and a resistance Z are connected between the grid and filament. The function of the choke is to block the a.c. and pass the d.c. negative charge. The negative grid-to-filament current is limited by the resistance Z to such a value that in the case mentioned where 30 volts negative are required there are 30 volts I.R. drop across the resistance. Thus, if we use 5000 ohms resistance, a current of $\frac{30}{5000} = 0.006$ amperes will flow, and the power applied to the control circuit is $0.006 \times 30 = 0.18$ watts.



Method of applying power.

Fig. 3.



Oscillator and Modulator Plate Circuits in parallel divide current through *K*.

FIG. 4

Showing the adaption of the Modulator Valve

Modulation

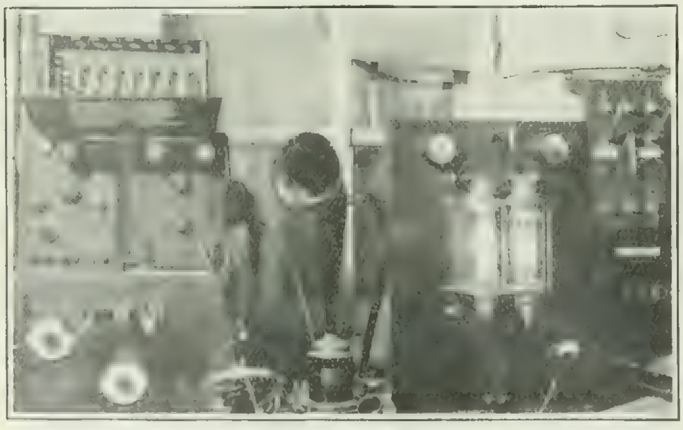
Now it only remains to couple up a modulator valve with an oscillating valve and we obtain modulated high frequency power. The method of coupling the two valves in common use today is known as the choke or constant current method.

The anodes of both valves are supplied through an iron core choke coil of inductance of about two henries. This choke coil serves two purposes, one of smoothing the commutator ripple from the generator and the second that of maintaining a constant current which divides between the two anodes depending on the respective grid potentials. Thus in the example above if the modulator grid potential swings to 40 volts negative it rejects 50 milliamps anode current which is forced over into the oscillator anode and vice versa if the grid swings to only 10 volts negative the modulator draws 200 milliamps and robs the oscillator accordingly, as the choke refuses to allow changes from the source of high voltage supply to take place at voice frequency.

If condenser C represents the radiating antenna then the radiated high frequency varies according to the variation of the potential of the modulator grid by the voice control.

Receiver

The receiver is the same as used for receiving wireless telegraph merely a tuned circuit resonant for the frequency to be received and a rectifier to cut off one half of the high frequency wave. A telephone diaphragm has too much inertia to vibrate at frequencies over 15,000 cycles and the ear would not detect the vibration if it were possible so by lopping off half of the modulated high frequency carrier a pulsating unidirectional current is left which corresponds to the voice control at the transmitting set.



Shawinigan Water and Power Company's High Frequency Telephone Set at Shawinigan Falls, Que.

The Shawinigan Water and Power Company has three sets in use at present located at Montreal, Shawinigan Falls and Victoriaville. The respective distances are 86 miles and 55 miles. The first pair of stations have been operating satisfactorily since December, 1920. There are some features which it was necessary to develop for the company's particular purpose as the apparatus is used by the regular operating staff. One very necessary feature is the call to attract the operator's attention. This was simply arranged by the use of an oscillating receiver slightly out of step with the incoming transmitter carrier wave. The difference between the two high frequencies produces an audible note which is amplified and finally reproduced on loud talking apparatus manufactured by the Magnavox Company. The note can be set at any pitch. It was found after some operating experience that there was some chance of the frequency changing slightly at either one end or the other so in order to produce an audible note a device for swinging the outgoing frequency about one percent was installed on each transmitter. This operates by merely turning a crank such as is used on an ordinary local battery telephone.

The call receiving circuit acts as an indicator of arcing contacts and grounds on any part of the H.T. system. We have been able to trace at least two cases when arcs were on, one in a cable on the distributing company's 12,000 volt system and one an arcing contact in an oil circuit breaker. Of course, these troubles usually show up in other ways but the call receiver attracts the operator's attention as soon as any. The ordinary buzzing noted on all high voltage insulators does not effect the receiver to any extent but arrester charging makes a lot of noise. It is interesting to note the varied strength from the distant arresters.

Another feature is the lightning protection. We operate the telephone through a lightning storm with no more interruptions than during a high wind or snowstorm. A flash of lightning is over in a fraction of a second and the induced noise in the receiver rarely obliterates a spoken word. The aerial circuit is isolated from the set proper by the coupling between the primary and secondary coils. In the circuits shown previously, the condenser representing the aerial capacity is an actual fixed condenser and a separate tuned circuit is coupled to the primary oscillator. In this aerial circuit coil E is variable for tuning the aerial circuit to resonance.

Condenser D has an insulation test of over 15,000 volts. Its purpose is to peak up low frequency surges so that they discharge to ground across the earth gap. High frequency surges or lightning will be opposed by the choking effect of Coil E, and will peak up and discharge to earth over the metal arrester gap. These gaps discharge when station electrolytic arresters are charged or when a severe power surge occurs. Inductance F shunted across the arrester gap drains off d.c. charging in windstorms, also in some cases our aerial is in a high voltage power frequency field due to close proximity of the power lines and this choke ties the aerial to ground potential for the low frequencies while the high frequency is isolated in the aerial.

The receiver used for the regular voice reception as distinguished from the call has a few steps of high frequency amplification. As a rule two or three steps are used. If four or more are used the noise due to the power induction becomes so great that no advantage is gained

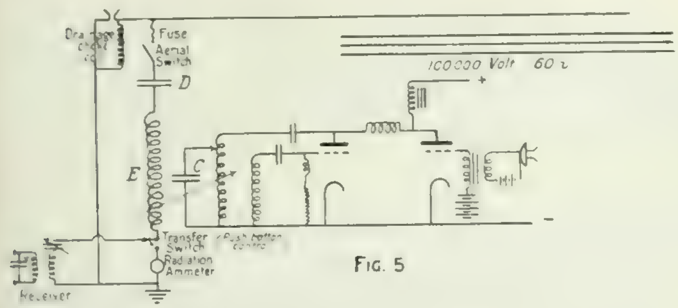


Fig. 5

Showing Adaption of Set to Aerial System and Transmission Line

in quality. The transfer from call receiver to voice receiver is made by merely lifting the head phones from a hook switch. This puts out the call valves and lights the high frequency amplifier valves.

Mention was made of the aerial system. This is radically different from ordinary wireless practice in that the aerial is located in close proximity to the high tension lines.

When tests were commenced everything was done to shield the apparatus and place the aerial where it would be least exposed to the power induction. All tests showed a predominance of induction over signal. Static was barely noticeable as compared with induction.

Wired wireless was put in use for a time by connecting the aerial coil to the centre tap of two condensers in series across the telephone line. These condensers were small capacity and well insulated so did not interfere in any way with the regular telephone operation. High frequency telephone tests were made with the telephone line open in several places and no weakening of signals was detected. As there was some danger of the power wires coming in contact with the regular telephone line a stretch of similar construction to the telephone line was built about 3000 ft. long at each station and functioned quite as well as the telephone line itself with less noise. On account of the length thought necessary to make the exposure to the power wires, the resistance of the aerial is necessarily high and its capacity large for wireless frequencies. An aerial of high resistance requires energy to be applied at a high voltage. Consequently it was found that by using a step-up ratio in the coupling between the set and the aerial inductances and tuning the aerial by means of a small capacity in series the power available in the set could be applied with fair efficiency to the aerial. Where normally in a standard aerial three amperes would oscillate only one ampere would be indicated in the long transmission line aerial, the power taken by the set being the same in each case. The comparative resistance can be worked out from current reachings applied to the I^2R law.

Reception on this type of aerial as stated before was better than over the wired wireless (direct connection to the telephone line). It is unfortunate that actual reception measurements are so difficult to make. The voice received over 87 miles is very much stronger than over any ordinary wire line that long and comparatively free from noise. When the head phones are put on some noise is noted but when the distant set power starts, the majority of the noise disappears or is wiped out by the high frequency carrier, leaving a quiet well modulated circuit infinitely superior to the telephone circuit which parallels the high tension lines.

The present system of operating is simplex, that is, one operator pushes a button and talks, then releases his button and listens. Duplex has been satisfactorily worked by using wavelengths differing by about 25%. This means that on one aerial wire we transmit one ampere at 150,000 cycles and receive a few micro amperes at 190,000 cycles. The only additional apparatus necessary is a rejector circuit between the transmitter and receiver tuned to the transmitter frequency. This offers a high impedance to the local frequency and allows all other frequencies to pass. The rejector circuit acts as so much inductance in the receiver aerial circuit and must be compensated for by a reduction of capacity to tune.

There is a tendency in designing a system of high frequency telephone communication over power lines to recommend a much lower power set than is used for the distance for ordinary wireless telephony. It depends on the service for which the set is to be used which is recommended the low or high power. If it is for ordinary everyday communication a low power set will be satisfactory but if it is to be a standby to be ready to operate when all other communication lines are gone a set of higher power will be necessary. It is not easy to obtain data on this point but a set to be of any use during an emergency must be capable of transmitting and receiving a signal during normal operation which is strong and definite, several times stronger than the weak signal which is just intelligible. With this surplus of power in normal times the chance is fair that the set will carry through an emergency.

A paper on this subject would not be complete without a word of warning to the companies thinking of installing a similar system. The Shawinigan Water and Power Company's experience has been that the apparatus cost is only a small portion of the cost of installation. Complete sets are not yet on the market, and until they are, the assembly of parts into such a system requires a great amount of costly experimental work.

It would not be right to close this paper without mentioning B. L. Silver who commenced the investigations for the Shawinigan Water and Power Company early in 1919. First tests were made in November, 1919, and results began to appear early in 1920. It was only when the transmission line was invited in to help in the fall of 1920 that real encouragement came. From that time the work of installation went on easily with the idea of making handling by the station operators as simple as possible. The sets are now tested for a few minutes each shift and if the weather looks bad at any of the stations, the battery switches are closed and the system is ready for instant use.

Developments in Sewage Disposal

A survey of the principal modern systems.

C. J. Mackenzie, M.E.I.C.

Paper read before Calgary Branch, The Engineering Institute of Canada, January 6th, 1922.

In the beginning, before there were any large centres of population the problem of sewage disposal was a simple one, but it existed nevertheless. From the beginning the elements making up the wastes from vegetable and animal life have passed through the same cycles through which they are passing today in our most highly organized sewage treatment plants. Ashes to ashes, dust to dust, is a scientific statement of the cycle of organic life as we know it to-day, and yet the science of sewage disposal has been developed entirely within the past fifty years and the major part within the past thirty.

The problem of sewage disposal in its most general aspect then is one of supplying facilities to permit nature to do its work with the minimum amount of danger and nuisance, the "New" force which the engineer is "Developing for the use and convenience of man" is in this case a biological one. As the cycle of organic life is the basis of the science of sewage treatment it is essential to arrange our ideas clearly on this before reviewing the various steps in the development of the science. In the fall the leaves dying cover the ground with a layer of dead organic matter, but no objectional conditions arise. In time it is worked upon by hordes of living organisms of the microscopic order, and the organic matter is gradually borken down into such form that it is easily oxidized into the stable inorganic compounds of the constituent elements. The carbon of the organic matter becomes carbon dioxide, the nitrogen is converted into nitrates and so on. This is the first part of the cycle. The second phase is the constructional step. Green plants as is well known, absorb carbon di-oxide, nitrates in solution etc., and by photo synthesis build up organic matter, which may decay and die as vegetable matter or by animals be converted into a still higher form of organic matter, after which the inevitable death, destruction and oxidation to the harmless and stable inorganic form, occurs in a continuous cycle. The Sanitary Engineer is concerned with only part of this cycle. It is his duty to see that the destruction and return to the inorganic form of all the organic constituents of sewage is done with the least possible amount of danger and nuisance. There is also another phase to the problem. Sewage contains a great number of living micro-organisms which are important not because of the organic matter contained in them, but because they are able to transmit specific diseases such as typhoid fever. These organisms are known as pathogenes or pathogenic bacteria. The proper disposal of sewage requires that these bacteria must not be allowed to become a menace to the health of any community.

Objects of Sewage Disposal

Briefly then there are two objects in sewage disposal, first the treatment of the organic matter in the sewage, second the treatment of the bacterial content. In some cases it is not necessary to remove the bacteria from the effluent, in other cases the removal of the bacteria is the main object of the proposed method. Each disposal scheme is then a definite problem in itself and there is and can be no such standardization of plans and of designs as are found in other branches such as structural engineering.

The early developments in sewage disposal are best exemplified by their history in Great Britain. There have been drains or so-called sewers since the earliest times, but up until 1815 the laws of Great Britain forbade the discharge therein of any wastes, so that while there existed sewerage in name, in reality, there existed only systems of drainage. As the cities became larger and the population more congested it became increasingly more difficult for the individual householder to dispose of the wastes from his household, and the accumulation of filth became so bad that a commission on the health of towns was appointed. The report of this commission in 1844 was far reaching in its results as it revealed the very bad and dangerous state of affairs, due to the accumulated filth in the cities. The chief result of this report was the introduction of the water carriage system of sewage removal, and in 1847 the policy which was in force up to 1815 was reversed and the discharge of all sewage into the existing drains or sewers was made obligatory. Before the general adoption of the water carriage system the pressing problem was not one of sewage disposal, but one of sewage removal from the immediate environment. of the individual. With the introduction of water carriage the removal from the individual was accomplished in a very satisfactory and sanitary manner, but the town or city was then confronted with the problem of having properly to dispose of the total wastes of the community, which had been so conveniently collected and conducted to some place on the outskirts of the town. This problem then of disposing in a sanitary manner, of the organic wastes of a community which are held in suspension and solution by about 1000 times their volume of water, is the sewage disposal problem of today.

Naturally at first the sewage was discharged directly and without any precautions into the nearest body of water, either a running stream or the sea. This went on practically unnoticed for a few years until the pollution of streams became objectionable and dangerous. In 1857, in England, a Royal Commission on the sewage of towns was appointed whose duty it was to inquire into the best means of disposing of the sewage of towns and cities. Eight years later in 1865 this Commission made its final report in which it stated that "The right way to dispose of sewage is to apply it continuously to land and

it is only by such application that the pollution of rivers can be avoided". After the general principal had been established that all sewage must be treated before being discharged into streams (from which water supplies are to be taken) the development has consisted in the gradual evolution of more economical and more efficient methods of sewage treatment.

The developments in other European countries were along similar lines the first method of sewage treatment being to apply it directly to the land, and we still have today examples of sewage farms which are in operation and giving satisfactory results.

Undoubtedly the final effluent from sewage farms or from so-called broad irrigation, is as good if not superior to the best known artificial methods of today, but the large area of land required, the necessity of having a suitable soil and the doubtful economic aspects have all tended to discourage this method of disposal and the sewage farm is seldom considered to day except in arid regions where the benefits of irrigation are all important.

Intermittent Sand Filtration

The difficulties of broad irrigation suggested naturally the system of treatment known as "Intermittent Sand Filtration". It was found that on farms where the soil was sandy little trouble was experienced and very satisfactory results were obtained. The land did not become clogged and "sick" as it did on those where the soil was heavy, also the quantity of sewage that could be treated per acre per day was greater (poor soil often as low as 2000 gallons per acre per day while 10,000 was often used on the best). These facts suggested the construction of an artificial bed of the proper sized sand, without any attempt at cropping, the advantages being a much higher rate of filtration, with the consequent smaller area required for the sewage works. Thus the "Intermittent Sand Filtration", the first artificial method of sewage treatment, was first suggested in England about 1870, but the English were very much interested in sewage farms and the above mentioned method was never generally adopted there. In fact so closely were the English wedded to Land Treatment that it was not until 1908 that the Royal Commission on Sewage Disposal admitted that it was possible to purify sewage as well by artificial methods as by land treatment and at that date the order was cancelled which had made obligatory the application of all sewage to the land as a final treatment.

Intermittent sand filtration has become suggestive of New England and the Lawrence Experimental Station of the Massachusetts State Board of Health, for the experiments which were started at this station in 1887 may truly be said to have demonstrated the scientific basis and practical sufficiency of this method of sewage treatment. Following the early experimental work referred to above, a number of plants were constructed in New England where the availability of large areas of suitable sand made this system very acceptable for that locality. In intermittent sand filtration the sewage is applied to beds of sand which are underdrained for the purpose of collecting the effluent. The dosing is done on the intermittent system, the sewage is applied for a short time at a high rate and the filter allowed to rest for a day or so. The sewage trickles down through the sand and the air contained in the pores of the sand oxidizes the organic matter. The amount of the dose and the period of rest, and the total air space in the bed must be adjusted so that there is sufficient oxygen to produce the desired results.

Intermittent sand filtration in general principle does not differ essentially from broad irrigation, but it is scientifically controlled and operated and rates of about ten times those of broad irrigation may be obtained, (namely up to 100,000 gals per acre per day). The effluent from a well operated plant is stable, and a bacterial removal of over 99% can be obtained. Where suitable sand is available in situs this method is one of the best, but its advantages are naturally confined to certain localities, and while there are a great number of such plants in successful operation, especially in the New England States, more modern systems have been selected for most of the installations of the past decade.

The development of the intermittent sand filters, as has been suggested, was an outcome of the desire to pass the sewage through the filtering medium at a faster rate than was possible in broad irrigation. The same desire was being felt in England but due to the fact that large bodies of sand were not available, naturally experimentors tried other means of obtaining the same end and we find the "Contact Bed", the first of the so-called "Biological Processes" being developed. As all methods of treatment really achieve their ends as was pointed out chiefly by aiding the oxidizing activities of micro-organisms, it is doubtful if any of the methods has any right to the name "biological process" to the exclusion of the others, however, these latter processes, were so-called in contradistinction to the systems of broad irrigation and intermittent filtration, chiefly, it is believed, due to the fact that they were more scientifically studied and controlled and were conceived by minds that were attempting to make use of biological life.

Contact Bed

The contact bed was developed, as has been stated, due to a desire to treat sewage at a higher rate per acre than was possible on sewage farms. As sand beds were not available in England a still larger filler was suggested. It was realized that if a large filler was used and the sewage applied in the ordinary way in bulk, the liquid would pass through the filtering medium so quickly that there would not be sufficient time for oxidation, settling out of the particles in suspension by surface contact etc. Dibdin, chemist to the London Council proposed to overcome this difficulty by modifying the usual procedure of allowing the sewage to pursue a continuous journey through the filter and proposed making the tank which held the filler material watertight, thus allowing the sewage to fill the tank, when the sewage could be held in "contact" with the filler for a certain time in order to allow the removal of a certain amount of the suspended matter and also to allow the oxygen contained in the interstices of the filler to oxidize the organic matter, as was done in the other

methods. The filter was to be next emptied and allowed to stand empty to allow the filter to be recharged with oxygen. It was considered that the action would be the same as that taking place in intermittent sand filtration and broad irrigation. This we know is not quite the case, but the results were fairly satisfactory, a high rate was shown to be possible (500,000-1,000,000 gals. per acre per day) and the effluent of fair quality. When Manchester adopted the contact system in 1900 numerous smaller cities and towns immediately followed her example.

Trickling Filter

While Dibdin and others were working on the contact bed idea, several other sanitarians in England and the United States were directing their attention in a slightly different direction. Arriving at the same point at which Dibdin arrived, namely that when either sand was not available or when still larger rates were desired a larger filler would have to be used, they too recognized that the sewage if applied in the usual manner would pass through the medium too quickly, but they met the situation in a different manner. Instead of applying the liquid as before and retaining it in contact, they decided to allow the filter to act as before but to apply the liquid in a different manner, namely to apply the liquid in a thin stream and not as usual in bulk. By applying in a small stream the liquid trickled over the filter in a thin film at a very slow rate, so that its passage through the filter was prolonged for a sufficient time to allow the desired aeration, and the filter medium was kept supplied with air all the time and conditions made very suitable for a ready and complete oxidation of the organic matter. This method became known as the trickling or percolating filter and the practical problem became one of developing some apparatus or arrangement that would distribute the liquid in the desired form over the filter bed. A number of inventions followed and we have the stoddart trays, the various mechanical distributors, so popular in England, and finally the stationary nozzles which are favoured most on this continent. The trickling filter has a high rate, from 1,000,000 to 2,000,000 gals. per acre per day. Generally it may be said that for ordinary conditions the trickling filter has an advantage over the contact bed. On the basis of the cubic yardage of the filler medium the trickling filter will treat about twice as much liquid as the contact bed, due in part to the fact that in the contact bed there is a gradual clogging and loss of capacity. Trickling filters adapt themselves to variable flows better, and the effluent from the trickling filter is usually more stable. The contact bed has the advantage of smaller loss of head, and less nuisance from odors and flies, which advantages are most pertinent in smaller and institutional installations. The bacterial reduction in both of these two methods is less than that of intermittent filtration and if bacterial reduction of any extent is required some form of disinfection must follow each of these methods.

The experimental work at Columbus, Ohio, in 1904-05 firmly established the trickling filter in America and up until the past 10 years this method has undoubtedly been most popular as the oxidizing unit in America Plants.

All the methods mentioned so far have to do only with the final or oxidizing stage of sewage treatment, and must not be confused with the preliminary treatment, which is a part of nearly all processes today, the development of which will now be traced briefly.

Sedimentation

It was early realized that if the grosser solids were removed from the crude sewage that the resulting liquid could be treated at a much higher rate on sewage farms, Intermittent sand filters, contact beds and trickling filters, accordingly the first measures consisted of some form of screen for the removal of floating matter such as sticks, paper, etc., and a preliminary detention period in some form of sedimentation tank where the reduced velocity permitted a considerable proportion of the solids in suspension being settled out. This principal of preliminary treatment is as sound today as it was then, the type of preliminary treatment has however been subject to developments.

Many experiments were conducted to ascertain the proper size of the sedimentation tank, period of detention etc., to give the most economical removal of solids. The total amount removed affects the cost of the final treatment, so that in considering the economics it is necessary to consider the treatment as a whole. The liquid effluent from plain sedimentation (which is a mere settling out and not holding of sludge for biological action thereon) was so much easier to treat than crude sewage that enthusiasts immediately argued that if a little removal was good a great deal more would be better and chemical precipitation was the result. Plain sedimentation on the average with 2-6 hrs. detention can remove from $\frac{1}{3}$ to $\frac{1}{2}$ of the suspended matter. A longer period of detention does not remove the remainder in anything like a comparable rate, as much of the suspended matter is in a highly comminuted and colloidal state, and does not settle out readily. The application of suitable chemicals however produces a coagulent and a high degree of clarification may be obtained. This process was taken up enthusiastically in England but has never reached the same degree of popularity on this continent and is seldom considered today unless under special conditions of trade waste. The chemicals most commonly used are lime, alum, copperas, ferric sulphate, and alumino-feric. While chemical precipitation gives a clear effluent it is not a final treatment and the great volume of sludge to be disposed of and the high cost of chemicals usually make other processes more desirable. A great deal of work has been done by agricultural chemists, especially in England in an endeavour to recover the fertilizing value of the sludge at a profit, but to date satisfactory results have not been obtained. The disposal of the sludge has always been, and is at present one of the major problems in sewage disposal from a financial standpoint as well as a sanitary one, and perhaps no phase of the problem is receiving more attention and thought today.

Septic Tank

In 1895 Donald Cameron designed a tank for Exeter which he patented under the name "Septic Tank" this

process has had a very marked influence on sewage disposal processes and great claims were made and much expected from it for a while, but time has shown that the claims and promises were much too optomistic. The process was hailed as the final solution of the sludge problem and was so regarded for a few years, but unfortunately the sludge problem still is with us. Since the early '80's' scientists, especially in France, had been considering the biological action in sewage. They had demonstrated that if liquid sewage was retained in a vessel from which air or oxygen was excluded or held in what they termed an anaerobic state, there was an action carried on by the aid of micro-organisms, called anaerobes, which resulted in some of the organic matter in suspension being liquified. In France, England and America tanks had been installed with trapped inlets, but it was found that the effluent from these was very troublesome. The septic tank of Cameron's was designed to overcome this difficulty and was operated in two steps the first the anerobic tank where complete liquification was supposed to take place and from which the effluent was discharged over a weir to a contact bed, where it was subjected to the influences of oxygen, called the aerobic bed.

Many plants were built in England and the process aroused great interest in America where Cameron and his associates took out patents, over which a great amount of litigation ensued. There is no doubt that the "Septic Tank" did a great deal towards clearing up the matter of biological action in sewage and sludge under anaerobic conditions, but the claims were greatly exaggerated and practice has shown that all the sludge cannot be liquefied and that the sludge problem still exists. The practice of patenting processes and methods, which pertains in England, is accepted there quite naturally, but in America such practice is not the rule and engineers felt that Cameron had no rights to principles which had been used and recognized for some time. The litigation caused by the septic tank patents is interesting reading and brought out a lot of valuable information. The legal difference in the United States between a septic and plain sedimentation tank was held to lie more in the operation than in the construction and engineers were able to evade the payment of royalties by cleaning out the tanks frequently and operating so that there would be some dissolved oxygen present at all times in the effluent. The unpleasantness of the above mentioned litigation prejudiced American engineers against the septic tank and they never became as popular as in England. The claims that the effluent from septic tanks was easier and more satisfactorily treated on trickling filters has not been borne out and if anything the reverse, namely, that the advantage lies with effluents from plain sedimentation, seems to be true.

Imhoff Tank

The next and most important development was the demonstration of the "Imhoff Tank" or the two stage sedimentation tank. The double compartment tank as we know it usually bears the name of Imhoff but its development was not totally due to him. There can be no doubt that the Imhoff tank was suggested by the Travis tank built at Hampton, England, by Dr. Owen Travis, in 1904. At that time there was a general feeling that by use of septic tanks followed by contact beds or filtration the organic matter in the sewage could be reduced to a satisfactory condition largely through the agency of bacterial life, but the actual experience in operating plants was not so satisfying. The much talked of liquifaction did not take place to the extent that was desired and clogging of beds occurred with objectionable odors etc. Dr. Travis concluded that the trouble arose because a large part of the suspended matter was non-settleable due to the fact that it was so thoroughly mascerated, and that this matter appeared in the effluent from settling tanks and clogged the contact beds. His idea was to remove this matter by allowing the particles to come in contact with plates on which the fine particle would collect. He therefore designed what he called a hydrolyzing tank. The tank closely resembles what we know as the Imhoff tank with a few minor differences. The tank was divided into three chambers, the two side chambers called the sedimentation chambers were like the upper story of the Imhoff and narrow openings or slits at the bottom of these chambers led into the liquifying chamber, which not only extended underneath the sedimentation chamber but also extended to the surface thus dividing the surface into three areas. The sewage was admitted to the sedimentation chambers where a number of plates were suspended, whose function it was to gather the fine matter in suspension, after which the solid matter would drop to the bottom of the tank and pass through the slots to the liquifying chamber, where it would decompose and the gases of putrefaction. would not come in contact with the main body of the fresh sewage. Dr. Travis contended that it was necessary to pass from 1/6 to 1/8 of the fresh sewage through the liquifying chamber in order to keep the sludge seeded with fresh bacteria. While Dr. Travis was essentially striving to establish the fact that the chief action was physical contact and the so-called hydrolyzing action, other sanitarians saw in his tank a means of overcoming one of the troubles of the single story sedimentation tank. It had long been felt that the decomposing gases arising from the sludge at the bottom of ordinary tanks, in passing through the liquid above caused the liquid to take on the foulness of stale sewage and make its subsequent treatment more difficult and offensive. Imhoff built a tank which had the features of the Travis tank with the exception that no plates were placed in the upper chamber and the liquifying chamber lay entirely underneath the sedimentation chamber and was connected thereto only by the slots in the sloping sides of the sedimentation chamber bottom. The gas from the decomposing sludge was removed by special flues discharging directly to the atmosphere above. This tank was taken up eagerly on this continent, especially was it accorded a friendly reception because American engineers were very displeased with the septic tank litigation and also because the tank seemed to meet the objections which had manifested themselves in ordinary sedimentation and septic tanks. The fresh sewage was not made foul by the gases of decomposition and the sludge itself was of a better character, contained less water and dried more readily. So well thought of was the Imhoff tank in America that from its inception until 1914 about 75 cities and towns in the United States had plants designed using them. In 1914 for complete

sewage treatment works the nearest approach to anything like a recognized standard that had ever existed for such in America, was probably screening, Imhoff tanks, trickling filters and chlorination, but today we are in the same condition as before and the results of experience since 1914 together with experimental results on new processes, have brought home quite clearly again that we are still in the development stage and that nothing like an universal and entirely satisfactory process has yet been proved.

The practical results of Imhoff tank operation have not been as satisfactory as could have been desired, much trouble having arisen from frothing and foaming and this year Baltimore in planning extensions has discarded the Imhoff tanks in favour of single story tanks with separate sludge digestion tanks after several years of experience with both, although it should be noted that special conditions pertain there. In Germany, Dunbar has even questioned the need for sludge digestion at all while other engineers have designed installations where the sludge is immediately conducted to a separate sludge digestion tank.

Within the past ten years several new methods have been experimented with on a working scale and much experimental work has been done on details. The three most important processes proposed in order of importance, are; the activated sludge process, the Miles acid process and the direct-oxidation process. The last named process is an adaptation of the old electrolytic process of purification which has been proved to be such a dismal failure and it is difficult to believe that the newer adaptation which is still more complicated can be made a practical success. This process consists of coarse screens; fine screens; grit chamber; electrolytic tank where lime is added and the sewage passed through a tank in which are rows of electrodes between which innumerable paddles revolve and across which an electric current is passed; and finally sedimentation. This system is in essence the old electrolytic process which has been definitely proved unefasible and it does not seem to warrant discussion.

Activated Sludge Process

The activated sludge process has no doubt been the most talked of development of the past decade and like so many other new processes raised hopes beyond their degree of realization.

The inspiration which led to this process is undoubtedly to be found in the experimental work of the Lawrence Experimental Station of the Massachusetts State Board of Health. In 1912 experiments were begun at this station on the effect of blowing air through sewage. The experiments were first conducted in gallon bottles but later tanks were constructed which were filled with layers of roofing slate. Most extraordinary and astonishing results were found, for besides a certain amount of oxidation, which was to be expected, the sewage was clarified more than by any of the other ordinary clarifying processes. In addition the sludge which was deposited on the slate was well fermented and inoffensive. Dr. Fowler of Manchester, England, observed these experiments and on his return to England arranged for experiments to be carried out there under Messrs. Ardern and Lockett who are really responsible for the discovery that the aerated sludge played the important part in the results obtained. They found that when raw sewage was first aerated it took about five weeks to obtain complete nitrification, but if the liquid portion was drawn off and further raw sewage when added the time to obtain nitrification was shortened and when this process was repeated several times it was possible to obtain nitrification in a few hours. The sludge which makes this possible was termed "Activated Sludge".

By this process a high degree of clarification and nitrification was obtained and the resulting sludge was flocculent in character and could be separated from water at quite a high rate. This process was widely proclaimed as the final solution of the sewage disposal problem and many experiments were started both in England and America to determine the best method of diffusing the air throughout the sewage, the best periods of aeration to adopt and the most economical amount of the sludge to treat given quantities of sewage etc. In this country the most elaborate and perhaps the most significant experiments were conducted at Milwaukee under the direction of T. Chalkley Hatton, and in consequence of these experiments that city has adopted this process for treating its flow of 130 million gals. per day. It should be noted that during the same period and after extensive experiments the cities of Cleveland and Worcester decided that this process was not suitable for them. In Milwaukee there were three conditions or requirements which the activated sludge process seemed to satisfy best. (1) The necessity for an effluent of 90-95% bacterial removal (2) Small area available for the plant. (3) The necessity of disposing of the sludge so as to avoid offensive odours and nuisance to the lake. At Milwaukee a great deal of experimental work was done on the best methods of drying the sludge and it was expected that the final product could be disposed of as fertilizer at a profit. Whether this can be done with the decreased price now prevailing is an open question and is subject to doubt.

At the present time it may be fairly said that this process is still in the experimental stage as to practical results. That it is undoubtedly one of the most important processes that has come to the front lately but that the difficulties of operation, the mechanical and practical difficulties of de-watering and recovering the fertilizing value of the sludge, the possible effects of trade wastes in the sewage and many other practical considerations point to the absolute necessity of carefully considering local conditions before adopting this process. The future success of the activated sludge process appears to depend upon the possibility of economically disposing of the large amount of sludge that is formed.

Miles Acid Process

The Miles acid process is essentially a process for special conditions and received its greatest prominence

due to the fact that it was recommended as the most suitable method of treating the sewage of New Haven where special conditions prevail.

In brief the process consists of treating the raw sewage with sulphurous acid which appears to have a selective toxic action on bacteria, more intense than the same hydrogen ion concentration of sulphuric acid. The procedure is to apply SO_2 gas derived from burning sulphur, to the sewage, which precipitates about 90% of the matter in suspension. The great advantages of this process are that substantial reduction in suspended matter is achieved and while the effluent is not nitrified it is sterilized. Further the sludge is in such form that there is the possibility of realizing on the fertilizing value. In addition to all the above advantages it has the special advantage of being comparatively inexpensive to construct. At New Haven the disposal problem required that the bathing beaches and shellfish layings be kept free from bacterial infection and nuisance from floating solids. The Miles acid process was held to have an advantage over screens, Imhoff tanks, or activated sludge, as the effluent from the Miles process has about 90% bacterial removal; sufficient removal of the solids in suspension; and while the effluent was not nitrified the large body of water into which it discharged was ample to achieve this result with no offense. It will be seen then that the Miles acid process promises to be a very valuable one for special cases.

The necessarily general review of the developments of artificial sewage treatment processes will, it is believed, show that there has not as yet been developed an artificial method of treating sewage which is entirely satisfactory as a general one and finality has by no means been reached. We are still in the development stage and, while the sewage of any city may be disposed of satisfactorily from a sanitary standpoint by a careful selection of known methods, every case must be carefully and intensively studied and treated as a special case and no method can be stated as a satisfactory standard for general use. One point should be clearly borne in mind and that is the ofttimes overwhelming influence of the economic factor and that progress and procedure in the sanitary field is more associated with availability of funds than is the case in most other fields.

Disposal by Dilution

So far nothing has been said about the most common and likely the most important single method of disposal, namely disposal by dilution, and it is desired to point out that disposal by dilution, or as we commonly know it by discharging the sewage into a large stream or other body of water, is scientifically just as properly termed a method of treatment as any of the artificial methods so far mentioned. That it is practically the most important will be realized from the following table which gives by provinces the number of people in Canada connected to sewerage systems and the number and percentage of these people who are contributing to sewerage systems served by disposal works.

Province	Pop. served by sewerage systems	Pop. served by Sewerage Treatment Works	Percentage of pop. sewered who are served by Treatment Works
Nova Scotia	164,000	0	0
New Brunswick	96,000	0	0
Prince Edward Island	14,000	0	0
Quebec	843,000	413,000	50%
Ontario	1,344,000	838,000	62%
Manitoba	210,000	8,500	4%
Saskatchewan	136,000	91,000	65%
Alberta	176,800	80,000	45%
British Columbia	312,000	26,000	8%
Canada	3,295,600	1,456,500	44%

(NOTE) The data for the above table were obtained from "Water Works and Sewerage Systems" published by the Commission of Conservation in 1916 and while some additions have no doubt been made since, the Table is sufficiently correct for the purposes used.

It will be seen from the above table that over 50% of the sewage of Canada is discharged directly into streams, lakes and tidal waters without any treatment whatever and a large part of the sewage nominally treated is discharged into lake waters after a very limited preliminary treatment, so that when the statement is made that disposal by dilution is one of the most important methods no exaggeration has been made.

Pollution

Sewage discharged into a body of water may become objectionable in three ways. First the dilution factor may be so small that the body of water does not contain sufficient dissolved oxygen to oxidize the organic matter in the sewage. If this is the case a very serious condition arises, the stream or body of water changes to an anaerobic condition with the emission of every kind of foul odour. This state of affairs occurred on the River Thames in the early days, and has occurred where the sewage of towns has been discharged into very small streams, but it is a condition of affairs that can never be tolerated and is seldom a problem in disposal, as it is rarely that such a small ratio of dilution is ever approximated. The best example of a disposal scheme where this criterion was the controlling one is that of the Chicago Drainage Canal, and the experience gained there and the investigations and experiments conducted for the solution of that scheme supply the most reliable data on the question of what dilution is necessary in order that the dissolved oxygen may be sufficient to oxidize the organic matter in solution and prevent the stream from becoming foul. The Chicago Drainage Canal was designed to give a dilution factor of 3.33 c.f.s. per 1000 population but observations now seem to indicate that a figure between 4 and 5 is more nearly correct. Langdon Pearse, sanitary engineer of Chicago Sanitary District, states, "From the viewpoint of nuisance prevention a sewage dilution of 4 to 7 sec. ft. of stream flow per 1000 pop. has been indicated with a lower limit of 2 and an upper of 10". It should be recognized that when a stream is polluted to this extent, while it will purify itself in time, it would not be safe to use this

supply even after water filtration until the water had flowed a long distance.

Following the opening of the Chicago Sewage Canal the State of Missouri instituted legal proceedings claiming that the Mississippi at St. Louis, a distance of 357 miles from the source of pollution and from eight to eighteen days in matter of time, was infected by the Chicago Drainage Canal and the water supply of St. Louis made unsafe. A great deal of evidence was submitted but no definite legal findings were made. It was held that damage to St. Louis had not been proved but the case was dismissed without prejudice, thus admitting that while proof of damage was not established that it was by no means certain the damage did not exist and that the City and State were free to open up the case again if desired. The result of the above mentioned trouble from an Engineering standpoint has been that a great deal of valuable and reliable information on the self purification of streams has been obtained. We may dismiss as a special case then the case where the dilution factor is to be just sufficiently high to prevent a nuisance, and consider the more common cases.

The second way in which sewage discharged into a body of water may cause offense is in the unsightly appearance of the larger and grosser solids floating on the surface. This occurs chiefly in lakes, harbours, and is very offensive near bathing beaches. It would seem that common decency would dictate that all sewage being discharged into any such waters should be screened to remove such material even though it is not the source of any actual damage.

The third condition is the most important, namely that case in which sewage is discharged into a large stream or lake where the volume is large enough to oxidize the organic matter of the sewage without any appreciable reduction in dissolved oxygen, the actual dilution being so great that all traces of sewage soon disappear just by being mixed with a much larger volume of water. The real objection arising out of the fact that the diluting stream or lake has become infected with bacteria which makes the water, which is in other respects suitable for drinking purposes, unsafe to use.

This is the problem which faces the towns and cities which are situated on the Great Lakes, and on most of our large rivers, which are destined to be used for the water supply of other towns and cities further down the stream. In the majority of cases the diluting factor is sufficiently great to easily take care of the organic matter, although it is usually necessary to remove the grosser solids which are liable to settle out into the bottom of the river or lake and cause sludge deposits or beds which may subsequently become objectionable, but the bacterial infection is so great as to make the water unfit for drinking purposes immediately below.

The problem is a complicated one as it involves the rights of all parties living on the banks of the stream. Is it just that a large city should so pollute a stream as to make it unfit for domestic use for the town further down? Is it just that a city should be made to purify to the Nth. degree its sewage before discharging it into a stream in order that a small town below may be saved the expense of a water filtration plant which would not cost perhaps one hundredth of the cost of treating the city's sewage? Would the same stream be fit to use as an unfiltered water supply even if the city did purify its sewage? And what is the maximum infection that may exist in the raw water in order that the water from a good filtration plant may be considered safe at all times? The above questions have been a source of debate for the past years, but there is gradually evolving a safe and equitable policy with reference to this problem.

The whole question was faced very definitely and squarely some years ago by the International Joint Commission. Article 4 of the Treaty between Great Britain and United States under which the above mentioned Commission functions states, "It is further agreed that the waters herein defined as Boundary Waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property of the other." Complaints had arisen that this article was being violated and the Commission therefore decided to make a thorough investigation, which they did, and their final report should be carefully read by those interested in this phase of the problem. The commission approached the subject by calling in well recognized authorities and sanitary experts both from Canada and United States and by a series of direct questions bringing out the information desired. It was early seen that as the boundary waters consisted chiefly of the Great Lakes and large rivers such as the St. Lawrence, Niagara, etc. that the question of infection by bacteria was the only serious question.

Without going into the details of the report the writer would like to point out briefly the opinions expressed which by the international importance attached to them and by the standing of the experts consulted have tended more than any other thing in recent years to crystallize professional opinion on the general policy of the mutual responsibilities of sewage disposal and water supply plants of towns situated on the same river. There is a growing opinion that the program of sewage disposal and subsequent water supply on the same stream should be considered as a single problem and the solution lies along the lines which will give the greatest total benefit for the minimum expenditure.

The Joint Commission found that the using of a stream for drainage and sewage disposal constituted a natural resource and as such should be conserved, always keeping in mind the rights of the people as a whole and not only those of a single community.

The inquiry also brought forth the unanimous opinion that water supplies from streams and surface supplies which were not polluted by the sewage from any sewerage systems, but merely from the natural drainage of agricultural lands, rural communities etc. were not safe to use without filtration but were quite safe after filtration.

The next logical step was to ascertain how much infection it would be safe to allow in the water to be filtered, and then make any town or city so treat any sewage contributed to the given supply, to such an extent that no undue burden would be placed upon any water filtration plant. The substance of the findings of the Commission have been arranged in practical form by Prof. Earle B. Phelps of the U.S. Public Health Service as follows "In all cases where the actual stream flow below any one point of

pollution is less than 4 cu. ft. per sec. per capita of contributing population or where the net effect of successive pollution with proper allowance for self purification in the intermediate stretches exceeds the equivalent of one contributing person per 4 cu. ft. of stream flow sewage treatment shall be employed to reduce the net bacterial pollution to a basis of an effective dilution of 4 sec. ft. per capita as defined".

It may be said then that there is a growing acceptance of the principle that disposal by dilution is economically sound and proper under certain restrictions namely that the water supply of any community further down stream shall not be infected beyond the degree referred to, so that by proper water filtration a satisfactory supply can be obtained. That it is unwise and unsound to simply demand that every city or town shall purify all sewage discharged into a stream to the same degree. But that each case should be considered as a special one and the degree to which the sewage shall be treated shall depend entirely upon the conditions of the stream under consideration.

In attempting to cover in one paper the entire field of Sewage Disposal it has of course been necessary to treat everything in a very general way and no attempt has been made to enter into details at all. It will be noticed that matters of cost, which are admittedly so important have been left out. This has been done advisedly as cost data used to draw comparisons between different processes, stated for the general case, are more apt to be misleading, than of value. As it has been pointed out, every sewage disposal problem is a special case and should be studied as such, when it will be found that local conditions will largely govern the difference in costs between different methods. Before it is possible to state which system will be cheaper and best for any city it is necessary to study carefully and scientifically not only the local conditions as to composition of sewage, variation in flow, climatic conditions, characteristics of the body of water into which the final disposition must be made, but also the availability of suitable sites and the adaptibility of the existing sewerage system, for one system might mean the construction of an expensive intercepting or outfall sewer, the cost of which should be properly charged against such system. The final decision as to what system should be accepted will be governed by the two factors of cost and sanitary results desired, and unfortunately the cost factor is not always the minor one.

Rainmaking

The connection between meteorology, irrigation and vegetation.

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It is probably due to the military men of the past that we have the superstition that cannonading and the loading of the air with smoke particles can and does induce the rain to fall. The wounded from a battle, lying out on the battlefields and suffering, are made more wretched if the rain falls and adds cold and dampness to their misery, and the fact of the rainfall in such a condition fixes itself indelibly on the memory, while the fact that the weather is fine after a battle passes unremembered. Hence cases of a rainfall during and after a battle have been remarked on with wonder, so much so that a veritable superstition that it will be so after nearly all battles has arisen.

The British Admiralty once carried out a test to seek accurate information if rain could be made to fall by cannonading. A firing party with guns and ammunition once landed at a point on the coast of New Zealand where the air was usually heavy and moist. They fired away to their heart's content and reported that no certain results in the deposition of rain by the cannonading could be determined.

It is the writer's wish that some way to induce rain to fall, where and when it is wanted, might be reported here but it is impossible to do so and nobody is known who can. Only a little of nature's process is known and all that can be given here are the opinions of meteorological physics. The figures used on based government meteorological reports.

All forms of organic life and most of inorganic on our earth depends upon water and air. In every locality there are at least two forms of water, water itself and water vapour, or ice and water vapour. It is impossible anywhere to have ice, snow, or water, without having water vapour over it. When warm, the vapour will exist over the water in much greater quantity than over ice or snow when cold. There is a definite maximum amount of water vapour that can exist in the air for each temperature; and when warm, moisture saturated, air is cooled it can no longer hold its content of vapour and the excess is deposited as cloud fog or rain. The most important factor for the adequate and frequent supply of rain to a district is the supply of moisture. A simple calculation makes this plain. The weight of water falling on an acre in a one inch rainfall is about 113 tons, so that if a district of 100 miles radius (about 20,000,000 acres) wishes a rainfall of, say, four inches during a certain period of time, a total of about 9,000,000,000 tons of water must be provided. Therefore, when a heavy fall of rain occurs, a large amount of moisture is taken out of the air, and unless there were some agency for replenishing the supply there would come a time when permanent drought could not be avoided. Nature sees to the res-

toration of the supply of moisture to the air in her quiet and beautiful process of evaporation. There is always evaporation going on from the surfaces of water, snow or ice; more of course from water, but still the amount from snow and ice is also appreciable.

The higher the temperature the greater, and the faster is the evaporation, and consequently the great fields of evaporation for replenishing the vapour in the air are the oceans, and especially that part of the oceans in the tropics. These then are great supply reservoirs, and the distributors that convey the vapour over the world to support our life are the winds. There is an old saying: "He who controls the winds controls the rain".

Wind Formation

The pressure of the atmosphere at any level is not constant but varies from place to place and from time to time. In some regions it will be high, and inevitably, in other places, low. The difference of pressure causes a flow of air which is the wind from an area of high pressure to an area of low pressure. The air flows from higher pressure level to the lower. The greater the fall of pressure the stronger will be the wind — sometimes it will be a hurricane; and the less the fall of pressure the more gentle will be the wind.

The government meteorological offices make out the weather charts by plotting on a map the pressures at a given time at different places of a region. This method has been going on for years and now we know that these areas of high and low pressures have very definite forms, and very definite wind circulations, in the form of spirals, around them. These systems of circulating air travel, sometimes fast, sometimes slowly, and their tracks are now tolerably well known. All our storms are associated with the low pressure systems, while at the high pressure areas, the weather generally is fine and clear. Generally to the East of the low pressure area the weather is warm, moist, cloudy, and at times wet, while to the West the weather is clearing. The winds are often very strong from the West or North West with temperatures rapidly falling

Movement of Low Pressure Areas

It is the movements of these low pressure areas which bring the rain and snow. The position of any locality with respect to the centre of the low pressure area determines whether it will receive any of the precipitation.

In Southern Alberta we are just to the East of the Rocky Mountains which act as a barrier to shut off the warm, moisture laden winds of the nearby Pacific ocean, so that we probably obtain all or nearly all of the moisture which does fall from the more tropical Pacific ocean further South. Most of the storm tracks of this part of North America pass either to the South or North of Southern Alberta, so that we receive rain from only occasional storms which cross the region. It is due to this fact alone that the rainfall in Southern Alberta is often inadequate and very precarious. The effects of the mountain barrier on the climate here and at the British Columbia coast are well understood. Masses of warm, moisture-laden, air from over the Pacific strike the mountains and rise. In moving upward they expand and consequently cool. The excess of moisture must be precipitated and it descends as rain on the coast and snow on the mountain-tops. On the other side of the mountain barrier when the wind, deprived for the most part of its moisture, blows over the mountains and sweeps down into the valleys beyond, there is a compression of the air as it descends and a consequent raising of its temperature. It becomes therefore a warm wind, such as the "foehu" wind of the Alps and the "Chinook" of Montana and Southern Alberta.

Rain Formation

As has already been implied the only way that is known for the air to turn its water vapour into water is for the air to be cooled. We shall see that the amount of energy so involved is so enormous that the matter of the use of some kind of chemical agency by man to cool the air is out of the question. The only cooling we can think of is the natural process of nature in cooling by expansion.

It is illuminating to consider the refrigeration involved in condensing the vapour, — even assuming that there is a sufficient supply, — to provide whatever rainfall may be desired in a district. One inch of rain on an acre has a weight of 113 tons. To condense this from vapour requires cooling to deprive the vapour of its latent heat. We know that this amount of latent heat is about the same as the latent heat given up by 800 tons of water in being frozen to ice. Now we know from refrigeration data that it would take a 2,000-horse power refrigeration plant to produce 800 tons of ice in a day. If four inches of rain were made to fall over an area of 100 miles radius, in as long a time even as 100 days, it works out that 800,000,000 horse power would be required, working all the time.

This estimate leaves out the cooling of the air containing the vapour, which necessarily would be involved, and which also would be enormous.

Let us look at the problem in another way. The water fallen in a rainfall must have been supplied from vapour which was sometime previously produced by evaporation. To evaporate enough water to supply an inch fall of rain to an acre (i.e. 113 tons of water), requires all the heat produced by burning eight tons of good coal. For a four-inch rainfall on an area of 100 miles radius, the equivalent of the heat from burning 640,000,000 tons of coal would be required. We see in this matter of a simple rainfall, one of nature's great wonders that we rarely think about, and over which man is powerless. Nature accomplishes this colossal operation steadily, consistently, and quietly, and, to our shame, almost unregarded by us with gratitude or wonder. Measurement of the heat given out by the sun to our earth, shows that the sun's heat is sufficient to evaporate enough water to give an annual rainfall of 40 inches over the entire surface of the earth, and still have some to spare.

Even when there is a sufficient supply of water vapour to a district, and there is the necessary cooling to condense it to water, there yet remains another great problem involved in its condensation and subsequent fall to the earth. After condensation it is another great problem to make the water fall.

Some physicists hold the idea that the vapour in the air cannot be condensed unless there are dust particles, or electrified particles in the air to act as nuclei for its condensation. This is a very interesting consideration. It is certain that very small particles are of important assistance in enabling vapour to condense, but whether they are always essential is an undetermined question. Experiments show that the fewer the particles present for the same amount of moisture in saturated air, the larger will be the drops and the faster they will fall. Drops fall at a rate depending on their size and by measuring the rate at which they fall, and knowing the weight of water so precipitated, it is possible to calculate the number of drops and their size. So it has been found that fog particles are about 1/2500 of an inch in diameter and fall seven inches a minute; light rain drops are 2/100 inch in diameter and fall 400 feet in a minute; and heavy rain drops are 6/100 inch in diamteer and fall 1000 feet (i.e. about 1/5 of a mile) in one minute.

From these figures we can estimate approximately,— and we do not pretend it to be any better than a rough approximation,— the amount of rainfall obtainable from a cloud. The size of fog particles is so small, and they fall so slowly, that they could never of themselves reach the ground. From 1000 cu. feet of air filled with fog particles, there is obtained only 1/150 ounce of water, but the number of drops in this volume is as great as 420,000,000. If in some way, these droplets each could be made by a plentiful supply to grow to the size of large rain drops, there would be a yield of 24 cu. feet of rain. If we, therefore, consider a column of cloud, 1000 feet high, — which is about the thickness of many clouds, — on a base of 100 square feet, it would yield 288 inches of rain, a veritable deluge. The figures show then, that there are in the air always far more than enough particles on which vapour can condense to form rain. In fact the evidence is that the proper artificial course to pursue, if we could pursue one, would be to reduce the number dust partticles in the air, so that the air contained relatively few of them, and on these the vapour could condense in large drops that could readily fall. Even at that they might only fall a short distance and never reach the ground; for, unless the air were saturated, they would evaporate again as they passed through the unsaturated drier air below the cloud level. Neither is it possible, after the fog particles are formed, for them to unite to form large drops and thus get to earth. In that case the rainfall would be insignificant, amounting to only 2/3 ounce from a cloud base of 100 feet square and 1000 feet high.

The great point of all these figures is again to show that we must have enough moisture supplied. If there is, there are plenty of particles in the air to condense it. To sum up, — let us think of the ease and simplicity of nature's mechanism for a simple fall of rain, and at the same time not fail to remember the immense energy involved. To the east of the low pressure area the air is damp and warm, and on account of the density and pressure distribution in the circulating air it is forced to rise. As it rises it expands and is therefore cooled, and when it reaches the cloud level it is saturated. In passing up through the cloud the moisture is condensed on the fog particles already there, and these grow rapidly in size. As they grow they fall, thus coming in contact with more saturated air. By this time they have become fair sized drops and can fall as rain. The rain will continue just as long as the cloud is fed with saturated air, but as soon as the supply of saturated air stops the rain will cease. This is the main process, other factors are casual and non-essential. The volume of air required to yield the moisture for a rainfall of four inches on an area of 100 miles radius is enormous. If the air is saturated at 60°F and is then cooled by only 10 degrees, i.e. to 50°F. the air current supplying the moisture would be something like 200 miles wide, 700 yards high, and 3500 miles long.

Some of the physics of a rainfall have been given to you. The works of man are puny in comparison with the operations involved and it has taken many years of persistent observation and study to elucidate the process. It is a good example that the service of science is that of truth. Science forwards her researches and applies her principles and methods within the realm of all observable phenomena. Her followers usually are not materially rewarded, and her true devotees will not take advantage of those who may be unfortunate or long-suffering. The method of science is painstaking, laborious. honest, and long. "There is abundant need for the use of the intellectual enlightenment which science can supply to counteract the ever-present tendency of humanity to revert to primitive ideas. Fifty years of compulsory education is but a moment in the history of man's development, and their influence is as nothing in comparison with instincts derived from our early ancestors, and traditions of more recent times grafted upon them. So little is known of science that to most people old women's tales, or the unsupported words of a casual on-looker, or the devices of the sincere misguided, or of the charlatan, are as credible as the statements and conclusions of the most careful observers. Within its domain science is concerned only with evidence. It claims the right to test all things, and then hold fast only to that which is true. It declines to accept popular beliefs as to thunderbolts, production of rain, influence of the moon on weather, or that of underground water or oil on a forked twig, solely and simply because when weighed in the balance these beliefs have been found wanting in truth. The interest of science in mystery is that of inquiring into the mysteries to find a natural reason for them. Mystery is thereby not destroyed by knowledge but removed to a higher plane." — (Sir Richard Gregory.)

The writer:

I have given you some of the physics of a very common and ordinary phenomenon; but it is precisely the common phenomena and things that we know least about.

THE

ENGINEERING JOURNAL

THE JOURNAL OF
THE ENGINEERING INSTITUTE
OF CANADA

VOL. V. May 1922 No. 5

Professional Meetings 1922

Vancouver: June sixteenth and seventeenth.
Winnipeg: September fifth, sixth and seventh.

Vancouver Professional Meeting

A tentative programme of the Vancouver Professional Meeting has been received by wire at Headquarters from the Secretary of the Vancouver Branch. This meeting, which will be held immediately following the Good Roads Congress at Victoria, is under the joint auspices of the Vancouver and Victoria Branches, the dates being Friday and Saturday, June 16th and 17th. The tentative programme includes:—

Friday, June 16th.

Morning: Papers on Town Planning and Irrigation.

Noon: Luncheon.

Afternoon: Visit and Inspection of Ballantyne Pier-Papers on Engineering in British Columbia and the Logging Industry.

Saturday, June 17th.

Morning: General session. Discussion on Institute affairs, particularly in their local application and including the question of reorganizing the British Columbia Provincial Division.

Afternoon: Sightseeing.

Change in By-Laws

The vote on a proposal to change section 52 of the By-Laws resulted over-whelmingly in favour of the proposal. The report of the scrutineers to Council indicated a contrary vote of seventy-six and an affirmative vote of eight hundred and seventy-one.

At the meeting of Council held on April 18th the scrutineers' report was accepted and the change in the By-Laws confirmed. Section 52 of the By-Laws will now read:—

"Each Branch shall be managed by an Executive Committee or Managing Committee consisting of:—

(a) A Branch Chairman, a Branch Secretary-Treasurer, and not less than three other members, all to be known as elected members and to be ballotted for by all members of the Branch entitled to vote at Branch elections.

(b) Those members of Council resident within the jurisdiction of the Branch to be known as ex-officio members, and

(c) The immediate Past Chairman and the immediate Past Secretary-Treasurer of the Branch, to be knownas members emeriti, these latter to be members for only the year immediately following their term of office."

Committee on Policy Meeting

As announced in the last issue of *The Journal*, the meeting of the Committee on Policy was held at Headquarters on April 11th and 12th, presided over by J. B. Challies, M.E.I.C., Chairman of the Committee with A. B. Lambe, A.M.E.I.C., Secretary. The following members of the committee were present:—Messrs. A.R. Decary, Walter J. Francis, C. C. Kirby, A. J. McPherson, Wills MacLachlan, Brig.-Gen. C. H. Mitchell, A. B. Normandin, F. H. Peters, K. H. Smith, W. G. Swan, J. G. Sullivan, K. B. Thornton, W. P. Wilgar, R. O. Wynne-Roberts and the Secretary of *The Institute*.

Serious deliberation was given to the agenda, which included consideration of the objects of *The Institute*, its relation to cognate bodies, its organization under the headings of membership, council and general, in addition to special matters relating to the welfare of *The Institute*.

The result of the two days' deliberation will be embodied in a report to the Council of *The Institute*, and it is hoped that the entire membership will be advised, through *The Journal*, of the resolutions passed and informed of the important results achieved.

Gzowski and Plummer Medals

In the last issue of *The Journal* an illustration was given of the Leonard Medal. In view of the fact that the Gzowski Medal has been re-designed and a newly designed Plummer Medal accepted, illustrations of both these medals are shown herewith.

All the medals of *The Institute* are handsome in appearance, the illustrations not permitting a proper appreciation of their beauty.

Employing Engineering Students

Back in the active days a decade ago and preceding that for another decade the engineering students at the various universities found no difficulty in obtaining employment during the summer months. In fact, jobs or positions as the case might be were available for all and with little effort on the part of the students themselves. To-day an entirely different situation obtains and a serious problem confronts many of the young men who find it necessary to add to their resources in the summer sufficient to enable them to continue their courses during the following year as well as those who wish to obtain additional practical experience.

It is highly desirable, therefore, that every assistance be given our student members in getting them placed for the summer where they may earn and learn. After considering the problem, the Council of *The Institute* resolved that all members in a position to employ technical men should be requested to lend every assistance and to give employment to as many students during the summer as possible. It was also suggested that when employing engineers for any position, the applicants be asked to what grade of membership in *The Institute* they belong.

Membership in *The Institute* to-day stands for something definite and tangible and the desirability and value of membership will be greatly enhanced by the adoption and steady adherence to a policy such as is embodied in this proposal.

OBITUARY

Captain Louis William Klingner, M.E.I.C.

Captain Louis William Klingner, M.C., M.E.I.C., met a tragic death by drowning, in the Tigris river, word of which was received in Canada on April 13th, by cable, from the Department of the Secretary of State for India. The late Captain Klingner was born at Toronto on June 10th, 1886, and graduated from the University of Toronto in 1907, which was followed by a post-graduate course in reinforced concrete at Columbia University, New York, during 1909 and 1910, at which time he was detailer and checker of structural steel and reinforced concrete design for the engineering department, New York City. This was followed by the position of superintendent of construction, with the Foundation Company of New York, during 1910 and 1911. Returning to Canada, the late Captain Klingner became resident engineer of the Canadian Pacific Railway Company on construction of a double track at Perth, Ont. The years 1913 and 1914 were spent as company engineer with the Dominion Construction Company at Toronto.

Captain LOUIS WILLIAM KLINGNER, M.C., M.E.I.C.

At the outbreak of the war the late Captain Klingner enlisted, his record being continuous from September 1914, to July 1919. Enlisting as a Lieutenant with the 2nd Field Company, Canadian Engineers, he was engaged in instructing and training Infantry in field works and military engineering at Toronto. From April, 1915 to December 1915, he was in charge of construction work at Niagara camp; from December 1915 to March 1916 was with O.C. Depot Company at Engineers Training Depot, Ottawa; and from March 1916 to July 1918 he was with the 8th, 11th, and 10th Field Companies, Canadian Engineers, in England. From August 1916 to

May 1918 he was Lieutenant in the 10th Field Company, Canadian Engineers, in France; May 1918 to August 1918, Captain 10th Battallion, Canadian Engineers, and August 1918 to July 1919 Staff Captain, 4th Brigade, Canadian Engineers. Captain Klingner was awarded the Military Cross on November 16th, 1916, for exceptional courage in bringing in, under enemy fire, at the Somme a wounded Canadian officer. In this exploit he risked his own life, without hesitation, to save that of a comparative stranger. He was demobilized on July 6th, 1919.

On returning to Canada, the position of company engineer and comptroller of the International Corporation of Canada, Montreal, was given to him, and in 1920 he was appointed district irrigation officer in charge of all irrigation surveys in Mesopotamia, with the Irrigation Directorate, Bagdad, Mesopotamia, having under his control eighty-four local officers with parties in field. While making a trip from Bagdad to his Serrai headquarters, his motor launch was swept, by the swollen waters of the Tigris river, against a bridge pier, with such force that it was crushed and sunk in twenty seconds. The news of the death of Captain Klingner came as a severe shock to his many friends in this country, to whom his loss is irreparable. It will be difficult to find, combined in one person, such a generous nature, such sterling character and high ideals.

Joining as a Student in 1907, Captain Klingner was transferred to Associate Membership in 1912, and on January 17th, 1922, was elected to Membership in *The Institute.*

PERSONALS

Alan Timbrell, A.M.E.I.C., is now located at Simcoe, Ont., with Ontario Department of Public Highways.

D. T. Main, M.E.I.C., is with the National Steel Car Corporation, Limited, at Hamilton, Ont.

Lt.-Col. A. G. T. LeFevre, D.S.O., M.E.I.C., formerly of Antofa Gasta, Chile, is now with the Borax Consolidated Limited, Arequipa, Peru.

A. E. Woollam, A.M.E.I.C., formerly of Montreal, has accepted a position with the Wayagamack Pulp and Paper Company, Three Rivers, Que.

G. K. Waterhouse, Jr.E.I.C., who was formerly located at Kingston, is now with the Canadian Paperboard Company, at Frankford, Ont.

B. H. Segre, A.M.E.I.C., is on the staff of the Topographical Surveys Branch, Department of the Interior, in Ottawa.

John Rankin, A.M.E.I.C., is with the Department of Railways and Canals, at the Welland Ship Canal office, St. Catharines, Ont.

L. N. Boulet, A.M.E.I.C., formerly of Montmagny, is now with the Department of Public Works, Post Office Building, Quebec.

G. L. Hall, A.M.E.I.C., until recently of Isle Verte, Que., is now with the Department of Public Works, Post Office Building, Quebec.

R. McKillop, A.M.E.I.C., has been transferred by the Canadian Pacific Railway Company from London to Toronto.

H. J. Whiting, Jr.E.I.C., formerly with the Brompton Pulp and Paper Company, has accepted a position as resident engineer on road construction with Newton and Dakin Construction Company, Montreal, Que.

B. W. Paget, A.M.E.I.C., formerly of Niagara Falls, is now resident engineer on the James Bay extension, of the Temiskaming and Northern Ontario Railway, at Cochrane, Ont.

C. B. R. Macdonald, A.M.E.I.C., who has for some time been on construction work in Belgium, has now returned to England, his address being, Capel House, 54 New Broad Street, London, E.C.2.

Gordon L. Shanks, A.M.E.I.C., after spending the past year in Mexico on construction work with The Foundation Company has recently been appointed municipal engineer for Rockwood municipality near Winnipeg, Man.

F. W. Douglas, A.M.E.I.C., until recently assistant superintendent for the Foundation Company, at Mattamuskeet Lake Drainage, New Holland, Hyde County, North Carolina, has been transferred by that company to South Portland, Maine.

John G. Sullivan, M.E.I.C., President of *The Engineering Institute of Canada*, has been invited to report on the engineering features of the Pacific Great Eastern Railway which is owned by the Government of the Province of British Columbia.

David B. McLay, M.E.I.C., formerly of Vancouver, B.C., is still in Singapore, Straits Settlement, with W. Mansfield and Company, Ltd., and is at present engaged in the erection of a five-story office building. Mr. McLay contemplates revisiting Canada some time next year.

R. A. Ross, M.E.I.C., consulting engineer, of Montreal and M. J. Haney, M.E.I.C., of Oakville, Ont., have been appointed members of the Royal Commission recently established by Premier Drury for the purpose of reporting upon the affairs of the Hydro-Electric Power Commission of Ontario.

N. G. McDonald, Jr.E.I.C., has resigned his position as town engineer of Oshawa, Ont., and has accepted a position with Gore, Naismith and Storrie, consulting engineers, Toronto. During the period that he was town engineer, Mr. McDonald was in charge of several important undertakings.

S. W. Sawin, Associate Member of the American Society of Civil Engineers, was an interested guest at a recent luncheon of the Ottawa Branch. Mr. Sawin is a graduate of Dartmouth College and has been in Ottawa during the winter advising in the readjustment of the affairs of one of the Capitals' leading industrial concerns.

Andrew Galloway, A.M.E.I.C., formerly on the staff of the city engineer of Victoria, B.C., has been appointed business representative of *The Engineering Journal* in

Great Britain. Mr. Galloway is also prepared to supply information regarding engineering problems, or conditions in Europe to members, upon request. His business address is:—16 Ravelston Park, Edinburgh, Scotland.

Wm. H. Carson, M.E.I.C., district engineer in teh province of Ontario, for the Department of Marine, Ottawa, at the ordinary meeting of the Council of the Institute of Civil Engineers, Great George Street, Westminster, S.W.1., England, held on March 7th, 1922, was transferred from the class of Associate member to Member, (M.Inst.C.E.)

Colonel J. S. Dennis, M.E.I.C., C.M.G., of Montreal, chief commissioner of colonization and development for the Canadian Pacific Railway, has been asked by the provincial government of British Columbia to conduct an investigation into the resources and settlement possibilities of the country along the Pacific Great Eastern Railway.

President J. G. Sullivan and Secretary Fraser S. Keith, attended the spring meeting of the American Society of Civil Engineers at Dayton, Ohio, on April 5th to 7th. The first paper on the programme of the professional meeting was given by President Sullivan, "Flood Conditions in Canada". He also conveyed fraternal greetings on behalf of *The Institute* to the members of our sister Society in the United States.

A. W. Swan, B.A.Sc., Jr.E.I.C., for two years and a half on the Headquarters staff of *The Institute* as assistant editor of *The Journal*, sailed on the "Melita" for England on Saturday, April 15th. After receiving his education at Toronto University and acquiring considerable Canadian experience, technical, editorial, and business, Mr. Swan decided to take up his residence in England where his parents reside. During his stay in Montreal, Mr. Swan was active in musical circles and in boys' work. He takes with him the good-will of a large circle, who are interested in his success in his new field.

A. M. Snider, Jr.E.I.C., has resigned his position with the Canadian Ingersoll Rand Co. Ltd., of Sherbrooke, Que., to become assistant general manager of the Waterloo Manufacturing Company Ltd., of Waterloo, Ont. Mr. Snider who is an honours graduate in mechanical engineering of the University of Toronto has been with the Canadian Ingersoll Rand Company since graduation in 1917, first as assistant to the production engineer and for the last three years as production engineer. On leaving Sherbrooke, Mr. Snider was presented with a gold watch as a mark of appreciation by the staff and employees of the Canadian Ingersoll Rand Company.

With the permission of the Deputy Minister, Mr. J. G. Desbarats, C. M. G., M.E.I.C., and under the immediate supervision of Lt. Commander C. P. Edwards, M.E.I.C., superintendent of the Radio Branch of the Naval Service, concerts are broadcasted from the radio station on Vittoria Street, Ottawa. Members of the engineering profession are welcomed by the genial Commander every Thursday evening, when the concerts which are broadcasted from Schenectady, New York, and other important stations in the United States are received. A number of interesting addresses have recently been listened to at this station in Ottawa, among which was the address by Dr. Steinmetz.

D. M. Mathieson, M.E.I.C., of Toronto has completed arrangements for an extended tour of the Orient as representative of ten Canadian manufacturers. The lines which will be handled by Mr. Mathieson are chiefly of a mechanical nature including engines, pumps, boilers, roadmaking machinery, agricultural implements etc., although leather and paper goods are also included. Mr. Mathieson will visit London, Yokohama, Kobé, Tientsin, Shanghai, Hong Kong, Singapore, Bankok, Batavia, Colombo, Madras, Calcutta and Bombay and at each port of call will establish a Canadian representative to develop trade in the Canadian products which he represents. It is anticipated that Mr. Mathieson will be absent about a year on this initial tour.

Survey Pioneering

William Pearce, M.E.I.C., of Calgary, pioneer land surveyor of the West, was the guest of the Dominion Land Surveyors, at a luncheon on March 30th, and gave a very interesting talk on his early experiences. G. H. Herriot, M.E.I.C., president, occupied the chair, and at the table with him were Dr. Deville, C. A. Magrath, M.E.I.C., R. A. Davy, M.E.I.C., Thos. Shanks, Noel J. Ogilvie, M.E.I.C., and F. H. Peters, M.E.I.C.

Mr. Pearce's reminiscences carried him back to 1873 when he was employed on a timber limit on the Severn river. He had to carry a pack of 60 pounds and walk on snowshoes for the first time. Continuing, he told of his work in the Department of the Interior until superannuated in 1904. Since then he has been connected with the C.P.R. at Calgary.

New Assistant at Headquarters

N. E. D. Sheppard, B.A.Sc., A.M.E.I.C., has been appointed Assistant to the Secretary on the Headquarters staff of *The Institute*. As assistant editor of *The Journal*,

N. E. D. SHEPPARD, B.A.Sc., A.M.E.I.C.,
Assistant to the Secretary of The Institute.

Mr. Sheppard will have charge of its production, and as office manager, he will be in charge of the Headquarters staff and have the responsibility for the efficient handling of the routine business of *The Institute.*

Mr. Sheppard was born at Ottawa on the fifteenth of January, 1891, and graduated with the degree of B.A.Sc., from the Faculty of Applied Science, University of Toronto, in 1914. During the summers of 1908, 1911 and 1913 he was employed on survey work, and following graduation was appointed to the staff of the Dominion Water Power Branch as assistant to chief hydraulic engineer on water power investigation. In 1916 he was transferred to Nova Scotia as assistant to the district engineer of the Dominion Water Power Branch engaged on power investigation under the co-operative agreement between the Federal Government and the Government of the Province of Nova Scotia. From 1917 to 1920 he was engaged at the head office of the Dominion Water Power Branch, under the assistant director, on the preparation of the Directory of Central Electrical Stations in Canada and on a detailed study and analysis of the central electrical industry in Canada. In 1920 Mr. Sheppard resigned from the Dominion Water Power Branch to accept a position with the Riordon Company Limited at Hawkesbury as secretary of the vice-president and technical director, returning to the Dominion Water Power Branch in 1921.

Mr. Sheppard was admitted as a Student of *The Institute* on April 11th, 1914, and transferred to Associate Membership on August 1st, 1916.

Admitted in Eighty-first Year

That there is no maximum age limit for admission to *The Engineering Institute of Canada* is demonstrated upon the fact that one of the members just elected, whose picture appears herewith, Robert Angus, consulting engineer of London, Ontario, was 80 years of age on the 11th of January last.

ROBERT ANGUS, M.E.I.C.

Mr. Angus was apprenticed as a machinist to E. Leonard, founder of the present manufacturing establishment of E. Leonard and Sons, London, Ont., before the majority of the present members of *The Institute* were born, in the year 1865. Ten years later finds Mr. Angus engaged on the design, construction and installation of waterworks for the town of Sarnia. For the period between 1876 and 1890 Mr. Angus was engaged in the design and construction of steam engines for E. Leonard and Sons, where he became superintendent in 1891. At the World's Fair in Chicago in 1894, Mr. Angus received the diploma of honourable mention for skill as a designer of steam engines. In 1918 Mr. Angus was made a life-member of the American Society of Mechanical Engineers. In London where he is well known he is held in the highest esteem and the hope is expressed that he may long be spared to enjoy his membership in *The Engineering Institute of Canada.*

EMPLOYMENT BUREAU

AND

MEMBERS' EXCHANGE

To make this department more valuable it is proposed that in future advertisements of situations vacant should state salary, and give details of requirements.

Situations Wanted

Civil Engineer

Civil engineer, A.M.E.I.C., and graduate land surveyor open for a position at once. Experience eleven years of railroad location and construction, two years of highway construction and six years of private practice, municipal engineering etc. For personal reasons want a change and would be very reasonable about salary. Apply Box No. 99—P.

Mechanical Engineer

Mechanical engineer, A.M.E.I.C.; age 29; B.Sc; seven years experience on machine design and construction work. Open for engagement about May 1st, as mechanical engineer with machinery manufacturing firm or allied work, preferably in Ontario or Quebec. Salary $275.00 per month. Apply Box No. 100-P.

Engineer

Engineer, B.Sc., McGill, 1920, Jr.E.I.C., age 24, single. Overseas service. Experienced in paper mills. At present on McGill staff. Available end of June. Apply Box 96-P.

Draughtsman

Draughtsman, young man, now employed, but desires a change with opportunity for advancement and a broader experience in draughtsmanship. Over four years' experience, chiefly sketching, drawing and tracing of spare parts for repairs to machinery. Location immaterial. Can furnish excellent references, also sample drawings. Apply Box 97-P.

Civil Engineer

McGill University graduate 1910, A.M.E.I.C. Married, age 32. Nine years experience in charge of railway location and construction. In charge of railway company overseas. Two years experience as manager of large industrial plant. Would like position with firm of contractors or with industrial plant. Apply Box 98-P.

Manager

Executive or management, construction or manufacturing. Extensive experience with labour, estimating, costing. Wishes to change position for personal reasons only. Apply Box 95-P.

Structural Engineer

Structural engineer, A.M.E.I.C. and M.R.A.I.C., age 32, experienced in general building design and construction, including reinforced concrete grain elevators, mills and industrial buildings, good business training, desires position with consulting engineers, architects or contractor or would consider position with manufacturers sales organization, which would show possibilities for advancement. Available immediately, full particulars of experience and references reply to. Box No. 101-P.

Situations Vacant

Canadian Representatives in the Orient

The advertiser, the accredited representative in the far East of important Canadian manufacturers of agricultural implements, engines, pumps, roadmaking machinery and kindred lines, desires to interview men of high character and integrity who would undertake to act as resident managers of established branches in the Orient. Beyond the usual qualifications of a successful salesman a knowledge of the construction and application of the products to be marketed is essential. Civil or Mechanical Engineering training and experience is particularly desirable. Preliminary expenses must be borne by managers to and in assigned territory. The opportunity is offered for an excellent opening in foreign markets to men who can meet the requirements of the work.

If interested, write for appointment for interview, stating qualifications and giving full details of experience to Major D. M. Mathieson, M.E.I.C., 205 Confederation Life Building, Toronto, Ont.

Chief Traffic Officer

A Chief Traffic Officer for the Board of Railway Commissioners, Ottawa, at a salary of $6,500 per annum.

Duties.—To be responsible under the Board of Railway Commissioners, for the conduct of all traffic matters involving rates and practices pertaining to the service of railway, express, telegraph, and telephone companies; to direct the work of the traffic branch of the Board of Railway Commissioners; to investigate and prepare important reports to advise the Board on traffic matters; and to perform other related work as required.

Qualifications.—Education equivalent to graduation from a university of recognized standing; at least five years of experience in an administrative and construct ive capacity in an important railway freight or traffic department; wide knowledge of the structure, classification and application of railway freight and passenger tariffs; ability to meet and discuss traffic matters with railway and public service officials; executive ability of a high order. While a definite age limit has not been fixed for this competition, age may be a determining factor when making a selection.

Examination.—A rating on Education and Experience will be given from the sworn statements submitted by applicants on their application forms. To those who qualify, an oral examination may be given if necessary.

Foresters

Foresters at an initial salary of $1,680 per annum, which will be increased upon recommendation for efficient service at the rate of $120 per annum, until a maximum of $2,100 has been reached; with house or allowance in lieu thereof not to exceed $20 per month. This initial salary may be supplemented by whatever bonus may be provided by law.

Duties.—Under direction, to plan and supervise improvements on a forest reserve; to keep records, make reports, and handle detailed clerical work involved; to make surveys and inspections; to prepare estimates, maps, and plans; to classify forests and estimate quantities; to inspect and investigate forest operations, such as fire prevention, lumbering, scaling and the enforcing of forest regulations; to collect forest tree seed; to inspect privately-owned timber tracts upon request and advise owners in regard to handling forests; to assist in experimental work; and to perform other related work if required.

Qualifications.—Education equivalent to graduation in forestry from a college of recognized standing; experience in mapping and describing forest types; supervisory ability; good physical condition. Candidates must be 21 and not more than 45 years of age on May 11, 1922.

A rating on Education and Experience will be given from the sworn statements submitted by applicants on their application forms. To those who qualify, an oral examination may be given if necessary.

A list of eligibles will be established to fill the vacancies in the above class in British Columbia and Alberta.

General Directions

According to law a special preference is given first, to candidates who are in receipt of a pension on account of disability received as a result of war service and who have not been successfully re-established, and secondly, to candidates who have been on active service overseas and who are found to possess the minimum qualifications for the position. The age limit does not apply to such candidates.

Except in the case of positions at Ottawa, preference in appointment is given to residents of the districts where the vacancies occur.

Application forms properly filled in must be filed in the office of the Civil Service Commission not later than May 11. Application forms may be obtained from the office of the Employment Service of Canada, or from the Secretary of the Civil Commission.

By order of the Commission,

W. Foran,
Secretary.

Members' Exchange

For Sale

Report of 7th International Congress of Applied Chemistry. Report of 8th International Congress of Applied Chemistry, Volumes 1 to 27. Transactions of the Electro Chemical Society, from 1902 to 1914 inclusive. Apply Box 23—A.

List of Students at McGill University requiring summer employment.

Name	Year	Experience	Work wanted
Arnold, F. M.	I and II	Chemical analysis and metallography	Metallurgical work; specialty electric work.
Chalker, C. R.	I	Marine motor engines operation	Motor engines.
Coulbourn, A. P. R.	I	Apprentice to shipyard management; drafting; fitting shop, etc.	Any position, Montreal preferred.
Darker, W. H.	I	None	Electrical work.
DeLorimier, A. F.	I	None	Field work or anything that offers.
Gray-Donald, E.	I	Office work, road construction and repairs; building construction; levelling; water supply	Surveying.
Howe, R. W.	I	Farm work; checker on wharf; ship steward's clerk	Forest ranger; work out of doors.
Jarvis, R. C. B.	I	Electrical operator in charge of motor generator sets	Electrical work.
McCuaig, E. B.	I	Road construction; surveying	Surveying.
Miller, J. J. H.	I		Electrical work.
Shore, F. S.	I	Mechanic's helper and checker; ship yards	Surveying; forest ranger.
Nelligan, J. B.	I		Surveying.
Whitehead, J. G.	I	Chainman; mechanic; salesman	Mechanical shopwork or salesman.
Campbell, F. R.	II	Construction work in hydro-electric development	Construction work or drafting office.
Dick, G. M.	II	Pattern-maker; draftsman on tools and equipment	Engineering work.
Draper, J. M.	II	Rodman, taking levels for dams and running contours of lakes and rivers	Outside work, preferably instrument man.
Farnworth, G. J.	II	Shopwork on repair and erection of locomotives; electric and gas welding; surveying	Immaterial; in or near Montreal.
Finlayson, A. W.	II	Bank clerk and office assistant	Engineering work.
Gravel, A. L.	II		Surveying or mechanical work.
Harris, A. N.	II	Mechanical draftsman	Mechanical work.
Kirschberg, A. A.	II		Electrical work.
McEwen, D. W.	II	G.T.R. Arbitration Board, Engineering Dept.; Inspector of Good Roads	Clerkship or technical work in metallurgical plant.
Malkevitch, A.	II		Chemical laboratory work.
Mitchell, W. M.	II	Office work, surveying	Surveying or construction work.
Shaw, G. E.	II	Structural drafting and assembling	Drafting on structural steel; surveying.
Shlakman, V.	II	Salesman, shipper, stock-keeper, cashier, book-keeper, farm worm	Surveying or electrical work.
Smith, M. K.	II	Marine fitter's helper; clerical work	Clerical or engineering work.
Stewart, D. L.	II	Inspecting on fine limit and gauge work, charge of wharf office	Drawing office or shopwork.
Warren, W. A.	II		Electrical, mechanical or chemical.
Weisburgh, C.	II		Electrical work.
Mercier, A.	II	Clerical	Electrical work.
Taylor, M. B.	II	Chemical engineering work	Chemical work.
Bleau, A.	III	Foundry work, wiring, drafting, chainman	Metallurgical work.
Bown, W. E.	III	Steel mill and coke ovens	Industrial work.
Chisholm, J. D.	III	Machine work, instrumentman	Electrical work.
Cooper, P. E.	III	Instrumentman	Engineering work, (railway or structural).
Cossitt, L. S.	III	Machinist helper	Machine shop or drafting office.
Fagan, J. W.	III	Clerical experience	Mechanical engineering.
Friedman, V. E.	III	Machine work and inspection	Mechanical.
Gilbert, E. V.	III	Instrumentman	Highway construction.
Griffith, T. R.	III	Railway office work	Chemical work.
Goldberg, H. J.	III	Chainman; helper	Electrical work.
Harbert, E. T.	III		Drafting or shopwork.
Mitchell, J. M.	III & IV	Operation of acetic stills, asphalt testing	Chemical work.
Rainnie, R. J.	III	Machine and foundry work; bridge construction	Construction work.
Scott, J. M.	III	Electrical wiring and installation	Mechanical work.
Shier, B. B.	III	Power transmission construction; clerical and inspection work	Electrical construction work.
Velasco, F. M.	III	Mechanical drafting; surveying	Mechanical work.
Vrooman, H. W.	III	Work in salt laboratory	Chemical laboratory work.
Williams, S. W.	III		Chemical work.
Simpson, J. C.	III	Rodman and chainman	Outside work.
Black, H. M.	IV	Shopwork; wooden machinery	Automobile manufacturing concern or drafting.
Cartwright, G. H.	IV	Rodding; transmission line inspection; overseas	Will go anywhere.
Cousineau, C. A.	IV	Instrumentman	Civil engineering work.
Delaney, W. V.	IV	Topographical surveying	Hydraulic pertaining to hydro-elect. development.
Eager, N.	IV	Draftsman	Construction work.
Gurman, I.	IV	Machine repair shop	Chemical engineering.
Holmes, E. E.	IV	Shipyard shops; marine engineering; fire prevention	Any position, preferably in Montreal.
Irving, G. E. L.	IV	Pulp and paper mill operation; machine shop; rodman and chainman	Assistant chemist.
Johnson, E. L.	IV	Machine telephone shop; cost accounting	Production or industrial engineering.
MacNider, C. H.	IV	Drafting, electrical works	Engineering work.
Martin, K. B.	IV	Instrumentman; demonstrating automobiles	Railway or hydro-electric construction.
Mitchell, R. J.	IV		Electrical work.
Wait, E. H.	IV	Automobile assembling	Metallurgical work.
Woolward, C. D.	IV	Instrumentman	Construction or instrument work; drafting.
Handy, Lee	IV		Electrical engineering work.
Kerr, G. E.	IV	Transformer winding and general electrical work	Electrical work.
Simons, J. J.	IV	Helper electrical wiring and station operating	Electrical work.
Spratt, M. J.	IV	Resident engineer on road construction; instrumentman; geodetic survey	Construction or design of structures.

Elections and Transfers

At the meeting of Council held on April 18th, 1922, the following elections and transfers were effected:—

Members.

Robert Angus, consltg. engr., London, Ont.

John Dow, plant chief, Alberta Govt. Telephones, Lethbridge, Alta.

Alonza Clarence Selig, district engr., C.N.R. Eastern Lines, Maritime District, Moncton, N.B.

Joseph Emile St. Laurent, C.E. (Ecole Polytechnique), district engr., Dom. Public Works Department, Winnipeg, Man.

Ellwood Wilson, B.Sc. (Univ. of the South), mgr., Forestry Division, Laurentide Company, Grand Mere, Que.

Associate Members.

William Robert Alder, B.Sc. (Queen's Univ.), asst. res. engr., Dept. Public Highways, Ontario, Cornwall, Ont.

Albert Foster Baird, M.Sc. (Univ. of N.B.), professor of physics and electrical engr'g., Univ. of New Brunswick, Fredericton, N.B.

Gerald Lethwyn Bockus, supt. of power, City of Sherbrooke, Que.

Claude Hugh Brabazon, Geodetic Survey of Canada, Department of the Interior, Ottawa, Ont.

Bertram Edward Bury, Instr'man., Lesser Slave River survey, Public Works Dept., Dom. Govt., Edmonton, Alta.

Marcus Dow Cadwell, city engr. and supt. of municipal utilities, North Battleford, Sask.

Norman Keith Cameron, (Grad. R.M.C. Kingston), in charge of concrete work for the St. John Dry Dock and Shipbldg. Co., St. John, N.B.

Stanley W. Canniff, test engr., Ottawa Hydro-Electric Commission, Ottawa.

Frank James Clark, res. engr., Lethbridge Northern Irrigation District, Lethbridge, Alta.

Stanley Herbert Cunha, B.Sc. (McGill Univ.), elect'l. engr., engr'g. dept., Montreal Light Heat & Power Company, Montreal, Que.

John Clinton Donald, gen. mgr. and chief engr., B.C. & Alta. Power Co. Ltd., Fernie, B.C.

Owen William Ellis, M.Sc. (Birmingham Univ.), lecturer on metallography and on iron and steel. University of Toronto. Also consltg. metallurgical engr., Toronto, Ont.

Reginald Hugh Field, Surveys Laboratory, Department of the Interior, Ottawa, Ont.

Joseph Arthur Forgues, C.E. (Ecole Polytechpique), reinforced concrete detailing engr., Montreal Water Board, Cartierville, Que.

George Frederick Herbert Hilliard, (Grad. R.M.C. Kingston), res. engr., Lethbridge Northern Irrigation District, Lethbridge, Alta.

Homer Pasha Keith, C.E. (Univ. of Toronto), D.L.S., A.L.S., district highways engr. at Lethbridge, Province of Alberta, Lethbridge, Alta.

C. Camille Lessard, B.S.A. and C.E. (Laval Univ.), private practice with C. E. Gauvin, C.E., Quebec, Que.

Nathaniel Marshall, inspr. of boilers, Alberta Government, Lethbridge, Alta.

Henry John Gisborne McLean, Brantford, Ont.

William Jeffrey Moffat, (Grad. R.M.C. Kingston), asst. engr., Dept. of Highways, Regina, Sask.

John Mackenzie Moore, consltg. engr. and architect, London, Ont.

James Cundiff Nash, B.A.Sc. (Univ. of Toronto), elec. dftsman., Canadian Westinghouse Co., Hamilton, Ont.

Thomas Herbert Nicholson, executive engr., under N. M. Lash, chief engineer, Bell Telephone Company, Montreal, Que.

Harvey Arnold Smail, B.Sc. (Queen's Univ.), res. engr., Department Provincial Highways, Kingston-Perth, Kingston, Ont.

Gerald Bradley Snow, B.Sc. (Univ. of Toronto), asst. engr. with J. F. Grenon, Quebec Chibougaman Rly., Chicoutimi, Que.

John Henry Summerskill, B.Sc. (McGill Univ.) Riordon Co., Ltd. Montreal, Que.

Juniors.

Herbert Aldous, of Toronto, Ont.

John William Gamble Boyd, of Toronto, Ont.

Melville Grant Henderson, B.A.Sc. (Univ. of Toronto), Lethbridge Northern Irrigation District, Lethbridge, Alta.

Kenneth MacKenzie, B.Sc. (N.S. Tech. Coll.), engr'g. staff, publicity dept. Canada Cement Company, Winnipeg, Man.

Frank Leslie Mitchell, B.Sc. (McGill Univ.), research dept., service division, Abitibi Power & Paper Co., Iroquois Falls, Ont.

Alexander Thomson, dftsman, Lethbridge Northern Irrigation District, Lethbridge, Alta.

Associates.

Arthur John Ames, managing director ,"Instruments Limited", Ottawa, Ont.

Joseph Octave Massicotte, professor of technology, in charge of elect'l. test and laboratory, Montreal Technical School, Montreal, Que.

Transferred from the Class of Associate Member to that of Member.

Henry Arthur Brazier, city engineer, London, Ont.

James Leonard Busfield, B.Sc. (London Univ.), principal asst. to Walter J. Francis & Company, Montreal, Que.

Charles Walter Cornell, C.E. (Univ. of Toronto), district engr. of county roads, Prov. of Ontario, Toronto, Ont.

Frederick Alfred Dallyn, B.A.Sc. (Univ. of Toronto), director of sanitary engr'g. divn., Prov. Board of Health of Ontario, Toronto, Ont.

Edward Ewon Hawkins, outside supt. of constrn., reinforced concrete work, Port of Bristol, for Messrs. W. Alban Rickards & Co., Avonmouth, England.

Colin Dugald McTavish MacKintosh, supt., Lethbridge Divn., C.P.R., Lethbridge, Alta.

Patrick Philip, public works engr., Province of British Columbia, Victoria, B.C.

Herbert Thomas Routly, (Univ. of Toronto '06), private practice as contractor, Toronto, Ont.

Albert Ernest Sharpe, asst. engr., C.P.R. Winnipeg, Man., at present at Leader, Sask.

Athol C. Wright, asst. hydraulic engr., Reclamation Service, Dept. of the Interior, Ottawa, Ont.

Transferred from the Class of Junior to that of Associate Member.

David Cecil Mines Davies, asst. engr., Dept. of Highways, Regina, Sask.

Frank Parkin Flett, B.Sc. (Univ. of N.B.), mgr. sash and engr'g. dept., Trussed Concrete Steel Co. of Canada, Walkerville, Ont.

Sifroy Goulet, chief mech. dftsman. and asst. to mech. engr., Can. Gen. Elec. Co., Peterborough, Ont.

Pierre Maxime Henri LeBlanc, C.E. (Laval Univ.), D.L.S., Topog'l. Surveys Branch, Department of the Interior, Ottawa, Ont.

Ernest Norman Lyon, asst. engr., Indian Constrn. Co., Bombay, India.

Norman Geddes McDonald, (Univ. of Toronto), town engr., Oshawa, Ont.

Robert Cleland McKnight, (Grad. R.M.C. Kingston), B.C.L.S., county engr., Grey County, Owen Sound, Ont.

Francis George Rounthwaite, B.Sc. (McGill Univ.), gen. supt., The Bermuda Development Co., Tucker's Town, Bermuda.

Frederick Charles Rust, asst. to res. architect, Toronto Harbour Commissioners, Toronto, Ont.

Donald Alexander White, (Grad. R.M.C. Kingston), president, Taylor, White & Co. Ltd., Manufacturers Agents, Montreal, Que.

George Howard Wood, B.A.Sc. (Univ. of Toronto) asst. hydraulic engr., Reclamation Service, Dept. of the Interior, Ottawa, Ont.

Transferred from the Class of Student to that of Associate Member.

John Smythe Hall, B.Sc. (McGill Univ.), night locomotive foreman, C.P.R., London, Ont.

Transferred from the Class of Student to that of Junior.

Despres Dessane, asst. engr., Quebec Roads Commission, Quebec Que.

Eudore Giguere, C.E. (Laval Univ.), chemist-analyst of the City of Montreal, Lachine, Que.

Robert William Jickling, B.Sc. (Univ. of Man.), testing and inspecting overhead distribution system etc., City of Winnipeg Hydro-Electric System, Winnipeg, Man.

W. Bryce MacIntyre, B.A.Sc. (Univ. of Toronto), in charge of sewer design, Barber, Wynne-Roberts & Seymour, Toronto, Ont.

Hubert David Rogers, B.Sc. (Queen's Univ.), supt., Gananoque Waterworks & Sewerage System, Gananoque, Ont.

BRANCH NEWS

Victoria Branch

H. M. Bigwood, A.M.E.I.C., Secretary-Treasurer.

Visit of Vancouver Branch Chairman

A very profitable meeting of the executive was held on the 13th, when C. Brakenbridge, M.E.I.C., the Chairman of the Vancouver Branch attended and took part in the discussions. His interpretation of the point of view of his executive was of material assistance to the members present and helped to create an atmosphere suitable to proper co-operation between the Branches on several matters jointly affecting them. It is hoped that a practice so fruitful of good results will be oft repeated and every opportunity presenting itself made use of by members of either executive attending meetings of the other Branch and thus broaden the viewpoint of all concerned.

The question of holding a Western Professional Meeting of *The Institute* during the same week in which the Good Roads Association will hold their convention in Victoria is being taken up in an active manner. As previously promised the Branch will fall into line and support the Vancouver Branch in sponsoring such a meeting should they be able to arrange it.

Besides those interested in engineering matters who will attend the Good Roads Convention and who will be on the spot for a professional meeting of *The Institute*, it is hoped that the annual convention of District Engineers in the Provincial Public Works Department will also be held about the same time thus enabling them to be present both at the Roads meet and *The Institute* gathering. It will afford them an excellent opportunity to come into close personal touch with *The Institute*.

Another matter which is receiving attention is the advisability of putting the Provincial Division in a position to function. The division was organized some years ago but did not act and it is thought that probably the time has arrived when it may profitably do so. Opinions are being canvassed to this end.

Syria

F. G. Aldous, A.M.E.I.C., delivered a lecture on the 16th to only a small audience unfortunately, the subject being "A surveying expedition into Syria from Damascus to Aleppo", a number of excellent lantern slides being shown. The work of the expedition though primarily undertaken for military purposes, afforded opportunities of which the speaker had taken full advantage for obtaining pictorial records of the country passed through. The country being 'steeped in antiquity' and most names of places being found mentioned in the bible, it is said that some members are renewing their studies of the old testament with added interest.

The lecture was well prepared and the technical points relative to the survey proper were not lost sight of while the sidelight on eastern life as lived for a thousand years and more was decidedly interesting.

During the coming month an opportunity will be afforded members of visiting the dry-dock under construction at Esquimalt and an evening will be devoted to a description of the work before the visit is made.

Edmonton Branch

R. H. Douglas, A.M.E.I.C., Secretary-Treasurer.

The regular monthly meeting of the Edmonton Branch was held in the Edmonton Board of Trade Rooms on Wednesday March 15th, at 8 p.m.

The Branch, by resolution, went on record as approving the proposal to establish an Industrial and Technical Research Institute at Ottawa.

W. E. Roe, A.M.E.I.C., of the Canadian National Railways, gave a very interesting and instructive paper on "Railway Maintenance", describing the various problems a maintenance engineer has to contend with. Professor R. S. L. Wilson led in the discussion following the paper, also giving some personal experiences in railway work.

Dr. Boyle, Dean of the Faculty of Applied Science of the University of Alberta, gave an address on "Engineering Education", pointing out that the tendency of engineering education should be more towards the old apprenticeship system and that summer work, in the branch of engineering being studied, should be made a compulsory qualification for a degree.

Alex. Stewart, A.M.E.I.C., led in the discussion following and said it was his experience that engineering parties were often made up of students other than science men. After further discussion it was suggested by C. A. Robb, A.M.E.I.C., that steps be taken to ask engineering employers to give preference to engineering students.

Mr. Clyde Sutherland contributed much valuable information to the meeting in his paper entitled "Examination of Local Concrete Materials." Mr. Sutherland has for some considerable time been experimenting with the various sands and gravels used in the Edmonton district, for concrete. The results and the valuable data arrived at from these experiments formed the basis of Mr. Sutherland's paper. As a result of the discussion following this paper, it was decided to appoint a committee from the Branch to further investigate our local concrete materials and have the information so gained, made available to those interested.

Lethbridge Branch

G. S. Brown, A.M.E.I.C., Secretary-Treasurer.

At the General Meeting of the Lethbridge Branch of *The Engineering Institute of Canada*, held Saturday at 6.30 p.m., forty-three members and affiliates and two visitors sat down to dinner. The chair was occupied by C. M. Arnold, M.E.I.C., newly elected Chairman of the Branch. Popular songs were sung and solos rendered which were greatly enjoyed, after which a social intermission of fifteen minutes was called. Upon resumption, business of the meeting was taken up and the resolutions re Waterton Lakes, and support of Branch to Institute of Bureau of Standards and Research, were carried.

The speaker of the evening, John Dow, plant chief of government telephones, Lethbridge, was called upon and gave a very interesting paper on "Modern Telephone Engineering." Previous to giving the address, Mr. Dow conducted the Members of the Branch through the plant. This is the last general meeting to be held for a considerable time as the majority of our members will be going into the field. The meeting was a great success and all members are looking to the time when we will be having the General Meeting again.

Winnipeg Branch

Geo. L. Guy, M.E.I.C., Secretary-Treasurer.

An interesting meeting of the Branch was held in the University of Manitoba on April 6th, at which W. N. Smith, M.E.I.C., consulting engineer of the Winnipeg Electric Railway Company, presented a paper on the self-corrosion of buried lead pipes. Professor J. W. Shipley, in co-operation with the speaker, had been conducting a series of experiments on this subject for some considerable time, and the paper disclosed the results of the experiments.

It was pointed out that a great deal of pipe corrosion had occurred in sections of the city of Winnipeg in which it would be at least expected, if stray electric railway currents were to be attributed as the cause.

Reference was made to the large number of recorded instances of the corrosion of lead pipe in moist concrete. When lead is in contact with substances containing carbonates or bicarbonates it is very susceptible to corrosion. From the experiments it was shown that lead lost from twenty to thirty times as much by weight as other metals in the above compounds. Chlorides seem to affect both iron and lead very actively, while one plate of lead was shown to be affected by continued immersion in pure distilled water.

The speaker produced samples of light colored limy silt, which apparently contained a great deal of pulverized limestone. This is found to be most corrosive to lead pipes and is the kind of soil which surrounded samples of pipes found corroded in Selkirk and in Elmwood.

Border Cities Branch

J. Clark Keith, A.M.E.I.C., Secretary.

The regular meeting of the Border Cities Branch was held in the Cadillac Café on Friday, March tenth, the business of the evening being preceeded by a dinner in which twenty-five participated.

The following members were present:—Messrs. Baltzell, Newman, Porter G. F., Thorne, Allan, Bowman, Davis, DeKam, Fletcher, Keith, McIntyre, McMordie, Porter J. E., Richardson, Riddell, Tillson, Dustan. We were glad to see several new faces around the board whom we hope will soon be corporate members of *The Institute.* The minutes of the previous meeting were read and approved.

J. J. Newman, M.E.I.C., reported on the progress which had been made with regard to impending legislation.

Major McMordie, A.M.E.I.C., addressed the meeting on the formation of the 11th Field Company of Canadian Engineers in the Border Cities, authorization having been given by the Department of Militia and Defence. A special appeal was made to the younger members whose home ties would permit them to undertake the duties of officers N.C.O's or sappers. The war strength was given as 226 of all ranks, Major, Captain, 4 subalterns, and 2 supernumeraries, the peace strength having the same officers but half the number of sappers. One evening per week for four months would be devoted to training with two weeks at summer camp. Such training was beneficial physically and morally and tended generally toward the making of good citizens.

Major McMordie's appeal was sponsored by the Chairman who stated that he would have the whole hearted support of the Branch in the undertaking. Mr. DeKam with an experience of twenty years in the Canadian army, heartily recommended to the younger members that they seek the benefits which such training would certainly bring to them.

Work of the Field Artillery.

L. B. Tillson, A.M.E.I.C., gave a most interesting address on "The Work of the Field Artillery" with particular reference to personal experiences with 18 pounders. As a preface to his remarks, he outlined the division of the British Front into zones, each with its own field artillery for infantry protection. The selection of the battery position was of prime importance and after taking into consideration the various functions which it should perform, the spot chosen was plotted on ordinance maps within a yard or two with the aid of a prismatic compass and director. This ascertained, it was necessary to lay out the lines of fire. An outstanding object such as a stack or steeple centrally placed with regard to each particular zone known as the zero point, and within the enemies line was chosen and its location plotted on the map. At a short distance from the gun pit and in line with the zero point an aiming post was erected and the gun placed in position under darkness.

By the use of diagrams, the method of aiming the piece was clearly shown, together with the corrections which were necessary to overcome various errors which might be introduced. The duties of the gunner were three fold, first, to hit, second, to hit again, and third to press home the first two hits. This was not always easy of accomplishment as very frequently it was being done at night; without the knowledge that you had made a hit it was some comfort not to know that you had actually missed.

A heavy bombardment always preceeded an attack, each battery acting independently unless feint barranges are introduced at intervals similar to that forerunning an attack. The rolling barrages are developed by the Field Artillery. The fire advances by stages of 50 to 200 yards in advance of the infantry who proceed at a rate of about 35 yards per minute. The first barrage is usually on the enemy front line trench which forms the first objective of the attacking infantry. When captured the barrage moves on until the final objective has been taken. The ammunition used in the rolling barrage is 75% shrapnel and 25% H.E. The latter is more convenient and effective but too dangerous to friendly troops.

The bombardment of Paris by long range guns was described in detail. This commenced on March 23rd, 1918, and was continued at 15 minute intervals throughout the day. To fire a projectile from the German lines a muzzle velocity of 4,500 ft. per second was necessary and no such velocity had been known at that time, although it had been approached 25 years before. Subsequent examination of the gun showed it to be 121′ long, 8′ 2″ bore and weighing 318,000 pounds. The life of the gun was 50 rounds, but it could be re-bored twice before being discarded. The projectile was 40″ long and weighed 264 pounds. The muzzle end of the gun had a smooth bore section 6 meters in length. The shell was fired at an angle of 55% reaching an altitude of 24 or 25 miles. The path of this projectile was shown by graphs deduced by the speaker as representing the actual and theoretical trajectory. As an implement of war the gun was a failure both from the viewpoint of material damage or reduction in morale. It is of interest to note that the English gun constructed by Vickers Ltd. gave a range of 100 miles.

A vote of thanks was moved by J. E. McIntyre, A.M.E.I.C., coupled with the request that the speaker relate his more fearsome experience. This was modestly done and a near tragedy culminating in a comedy was productive of considerable merriment among his audience.

London Branch

F. J. Bridges, A.M.E.I.C., Secretary-Treasurer.
R. I. Olmsted, A.M.E.I.C., Branch News Editor.

The regular monthly meeting of the Branch was held on Wednesday evening March 22nd, in the Chamber of Commerce Committee Rooms, Tecumseh Hotel. About thirty members as well as several guests were present. H. A. Brazier, A.M.E.I.C., city engineer presided and after outlining the business to be transacted announced that Thos. Adams F.S.I., would address the members at the conclusion of the business session.

The minutes of the February meeting were then read and adopted. It was with regret that the resignation of G. C. Wright, A.M.E.I.C., Secretary-Treasurer was accepted. F. J. Bridges, A.M.E.I.C., was nominated to the office of Secretary-Treasurer and was unanimously elected.

An Amendment to the By-laws was then discussed wherein it was considered necessary to increase the executive by two members. After discussion and on motion the amendment was carried. The election of the two new executive members then ensued, the successful candidates being E. V. Buchanan, M.E.I.C., manager Public Utilities Commission, and R. I. Olmsted, A.M.E.I.C.

The advisability of electing Membership and Advertising Committees was then discussed and favourably received, E. V. Buchanan, M.E.I.C., being elected Chairman of the former and R. I. Olmsted, A.M.E.I.C., Chairman of the latter.

A discussion of the Professional Act, now before the Provincial Legislature, and progress outlined by H. B. R. Craig, M.E.I.C., was reported.

The Chairman, on behalf of the Ottawa Branch, presented to the London Branch two framed photographs of which these now form the nucleus of a collection, and for which a note of acknowledgement and thanks was passed.

The Chairman then introduced Thos. Adams, F.S.I., who chose for discussion the economical and imperative necessity of town planning and how intimately connected was regional planning with the whole scheme. As an instance of the importance of regional planning Mr. Adams gave a brief resumé of a recent consulting tour which he had completed during the previous Fall and early Winter, in England and Wales. Commencing January 1923, a law has been passed in England whereby it will be compulsory to have a town planning scheme prepared. Special reference was made to the Welsh coal areas and the districts of Manchester and Liverpool.

The speaker then referred to the progress that had been made on the American continent and more especially in the centres of New York and Boston. Mr. Adams then outlined in more detail the result of the study of the conditions affecting New York; and the steps which had been taken to improve the transportation, sanitation, and water supply for these very thickly populated and congested areas; and the problem which had confronted New York in obtaining a pure water supply and the necessity of obtaining large areas for reservoir purposes. To prevent contamination and for protection these areas had been made into beautiful parks, through which were constructed splendid parkways for automobile traffic and in some cases these extended into the country for a distance of thirty miles. The larger centres like New York, the speaker stated, were divided into districts for the purpose of carrying out a comprehensive town planning scheme, each district co-operating with those adjoining and the whole centre, with this district co-operation, was arriving at a very definite plan for the good of the whole community.

Referring to the progress which had been made in London in the preparation of accurate and detailed plans in which the Geodetic Survey, Air Board and the City Engineers' department had all co-operated with the result that the information which was then available and with the plans now under preparation, when complete, would contain more accurate and detailed information than would be available in any other city of its size in Canada and probably in the whole of the North American continent.

Mr. Adams then outlined the essentials which had to be considered in laying out a new area: proper control of the building in the areas already established; proper street widths, with and without street car traffic; location of sewers, etc. A point which he emphasized as having a very important bearing on the success of any town planning scheme was the co-operation which the municipal engineers could be expected to give, by taking a very personal interest in any plan which might be recommended.

Mr. Soper, A.M.E.I.C., moved a vote of thanks to Mr. Adams for his very interesting impromptu address.

Hamilton Branch

W. F. McLaren, M.E.I.C., Secretary-Treasurer.

A joint meeting of the Branch was held 24th March, 1922, with the Toronto Section, American Institute of Electrical Engineers, in the Westinghouse Auditorium at 8 p.m. The meeting was addressed by J. F. Peters of the Westinghouse Electric and Manufacturing Company, Pittsburgh, on "220,000 Volts Transmission and Equipment". This paper will be published in full in a later issue of *The Journal.*

Its reading was followed by a good deal of discussion which was shared in by Prof. Price of the University of Toronto, H. U. Hart of the Canadian Westinghouse Company, C. W. Baker of the Packard Electric Company of St. Catharines, and others.

Following the meeting, refreshments were served by the Canadian Westinghouse Company. A hearty vote of thanks was passed to the speaker for his excellent address and to the Canadian Westinghouse Company for their generous entertainment.

Mr. Dobson, Chairman of the Toronto Section, A.I.E.E., acted as Chairman for the meeting.

There was an attendance of about two hundred, including many engineers from Toronto and St. Catharines.

A special meeting of the E.I.C. members was held afterwards, at which the following Nominating Committee was elected:—F. W. Hubbard, Chairman; H. B. Dwight; H. B. Stuart; O. W. Titus; and the Secretary.

Peterborough Branch

D. L. MacLaren, A.M.E.I.C., Secretary.

Wireless Telephone Apparatus.

The Peterboro Branch have been very much interested in wireless telephony, due to the two recent lectures and demonstrations given in the city under the auspices of the Branch on March 23rd, and April 6th.

A. S. Runciman, A.M.E.I.C., Telephone engineer for the Shawinigan Water and Power Company gave an illustrated address on high frequency telephone apparatus, and also gave a demonstration in "Receiving". The speaker spent two days in the city superintending the erection of the necessary equipment for receiving with the result that the demonstration was so successful that it was decided to have a public demonstration on April 6th. Arrangements were accordingly made with the Canadian Independent Telephone Company of Toronto, who kindly consented to co-operate with the local Branch of *The Institute* in making this demonstration a success.

It was planned originally to listen-in on the concert given by the Toronto Star, but this was found to be out of the question, and, instead, some excellent music was heard which originated in Pittsburgh, Pa., Schenectady, N.Y., and Newark, N.J. Instrumental and vocal selections from all three cities and an announcement from the Brotherhood of St. Andrew of Trinity Church, Pittsburgh, were all heard with surprising distinctness.

Immediately preceding the lecture, and during the intervals between the selections a very lucid and interesting talk on the wireless telephone was given by Dr. Charles A. Culver, Ph. D., formerly Professor of Physics at Beloit University, and now radio engineer of the Independent Telephone Company.

Dr. Culver barred all technical terms from his talk and told of the wonders of radio communication in plain everyday language which could be followed and understood by all who heard him. He traced the developments of radio from its earliest inception, and prophesied great things for it in the future. He said that within a very short space of time, probably only a matter of weeks, broadcasting stations would be operating in Canada which would send out not only concerts and sermons but market reports and the general news of the day. By this means those who possess a receiving set would know the more important items of news before the newspapers were published.

In reviewing the history of wireless the speaker explained that while Signor Marconi had, by his discoveries, marked the greatest advancement in the science, yet he was not the discoverer of the electric waves which he utilized to carry his messages. This honour belongs to an English mathematician who was able to show mathematically that such waves existed. Their actual presence was shown some years later by a German school teacher.

The speaker referred to the fact that it had been noticed that concerts sent out from Toronto within the past few days could be heard distinctly, and for great distances to the east and south, while the same concerts could not be heard nearly as well to the north and west.

It was estimated that about 1,000 persons were present and following his address Dr. Culver answered a number of questions from radio fans in the audience.

Development of Electrical Works in Peterboro.

The Branch was given a most interesting evening when H. O. Fisk, M.E.I.C., manager of the Peterboro Utilities, gave an illustrated address on the "Development of Electrical Work in Peterboro" Mr. Fisk had a great many interesting anecdotes dealing with the first electrical installation in Peterboro.

The Annual Meeting of the Branch will be held on May 11th at 8 p.m.

Kingston Branch

L. T. Rutledge, M.E.I.C., Secretary-Treasurer.

The following report covers the operations of the Branch from February 10th to April 15th, due to the fact that the activities during February were not reported last month.

Fraser S. Keith's Visit

The members of the Branch had the pleasure of meeting our General Secretray, Fraser S. Keith, during the second week of February. Mr. Keith was a guest of Queen's University at the annual Science Dinner held in Grant Hall on February 9th. Mr. Keith made an eloquent speech taking as his subject "The Engineering Profession." He spoke briefly regarding the place the Engineer held in the industrial life of the country. The activities of *The Institute* during the past few years were outlined and he succeeded in making clear to the students present at the dinner, the advantages to be derived in being members of *The Institute.*

Mr. Keith stayed over for a day to renew old acquaintances and meet the new members of the Branch. A visit such as this is very stimulating to a Branch and makes a Branch feel that Headquarters is indeed interested in its welfare.

Development of the St. Lawrence for Deep Navigation and Power

On Tuesday evening, February 28th, J. M. Campbell, M.E.I.C., president of the Kingston Milling Company, gave an address on "The Development of the St. Lawrence

River for Deep Water Navigation and Power." Mr. Campbell is very much interested in this subject and is well qualified to speak on it. He owns and operates boats on the lake and thus his interest is in navigation.

In the address, the report of the engineers recently employed by the two governments was discussed. For the analysis, the river was divided into five sections as follows,—

1. Montreal harbour to deep water in lake St. Louis.

2. Deep water in St. Louis to the outer end of the proposed ship canal between lake St. Joseph and lake St. Francis.

3. From the end of the proposed ship canal as above to the lower end of St. Regis island.

4. The lower end of St. Regis island to Chimney Point.

5. Chimney Point to lake Ontario.

The speaker gave the dimensions of the proposed locks, canals and channels. In general, a depth of 30 feet is recommended. All locks are to be 800 feet by 80 feet. The question of the generation and sale of electric power was well covered. It appears that the Americans could immediately use over one million horse power, whereas the Canadian market would be slow in development but could ultimately be realized. The conservative costs as given in the Engineers' Report impressed the members very much. The estimated cost of a 30 foot channel and 1,464,000 horse power was given as $270,714,000 or the cost of a 30 foot channel and 4,100,000 horse power of electrical energy $506,199,180.

The speaker concluded by saying that the improvement of the whole section of the river from lake Ontario to Montreal for navigation alone is feasible, but the neglect of the opportunity to develop at the same time the available power in some stretches is not warranted.

Students' Papers

The next regular meeting was held on February 14th. At this meeting three prize papers written by student members of the Branch were read.

The paper winning first prize was entitled "A Canadian High Speed Steel Plant." It was written by A. A. Paoli, a final year civil engineering student. Mr. Paoli has spent three years in the steel electric smelting industry and has gathered such a valuable fund of information on the subject that he is indeed an authority on electric smelting and the operation and design of steel plants.

His paper sought to show that it was possible to operate a tungsten steel plant in the vicinity of Vancouver so that it could compete to advantage with the British and American industries. Incidental with the main object in view, a steel plant and high speed steel was discussed. The contents of the essay as submitted were as follows,—

1. Definitions of high speed steel, its uses, unique qualities, commercial status and manufacture of the steel.

2. Location of the plant as regards raw materials, freight rates, tariff, power, labor market. Design of the plant and description of the building.

3. Equipment entering into the manufacture of high speed steel. Design of a furnace.

4. The working of a typical heat. Details of refining and alloying. Metallurgical reactions.

5. Mechanical treatment of the steel.

6. Advantages of the duplex process over the crucible process of making high speed steel.

7. Analysis of costs for a Canadian operated plant.

The paper was well illustrated by slides and the subject matter was presented practically without the help of notes.

The paper winning the second prize was entitled "Modern Conceptions of the Nature of Electricity." It was presented by Bruce Saunders S.E.I.C., a final year electrical student. The speaker first reviewed the older theories of electricity namely, "the one fluid theory", the "molecular theory" and the "displacement theory." The latest theory, the "electron theory," was then introduced and dealt with very fully.

The electron was defined as the smallest quantity of electricity possible. All electrons, no matter from what atoms they were extracted are similar. The mass of an electron is 8.8×10^{-28} grams. The mass of an electron depends on its velocity. All electrons are of the same polarity, being negative. It was demonstrated that the normal atom had enough electrons in it to neutralize the positive charge of the atom itself and then the atom acts like an uncharged body, not because it has no charge but because the two charges are neutralized. An atom is positively charged when it has lost one electron. Should a normal atom receive an extra electron, then it is negatively charged, although there are a great many electrons associated with an atom, it is not possible to remove any more than one of them.

From the view point of the electron theory, electric fields, electric conductors and electric currents were considered. Electric currents were explained to be the progressive movements of electrons. Though the individual electron bounds and rebounds with the speed of light yet the drift of electrons is very slow. In producing a current of one ampere in a copper wire one millimetre in diameter the average velocity of drift is only 0.1 millimetre per second. Thus an accurate concept of electric current was shown to be an inappreciable drift of electrons which, due to the effects of temperature, have dissimilar velocities millions of times as great as the velocity of drift. Mr. Saunders compared this drift of electrons to the movement of people past a crowded corner in New York city. Though the individual movements in an hour are very numerous, yet the net progress made in one direction is very small.

The third paper which was awarded third prize by the reading committee was entitled "A Concrete Arch Bridge." The speaker was H. R. Myers, S.E.I.C., final year civil engineering student. Mr. Myers presented his paper so clearly and masterly that the committee reconsidered their decision, finally deciding that Mr. Myers' and Mr. Saunder's paper were of equal merit and accordingly each received a second prize, the prizes being given in cash.

Mr. Myers explained the construction of the concrete arch bridge from the beginning of the work to its completion. The form work, and reinforcing etc., were well illustrated by slides.

All the papers were well discussed and many of the older engineers present commended the idea of having student papers presented.

The Annual Dinner

The last regular meeting was held on February 28th and took the form of a dinner, which has become an annual event. There were no set speeches. Everyone was expected to make a three minute speech and tell a story. Some rose very ably to the occasion. Our Chairman, Professor Wilgar, was in excellent form and contributed very much to the success of the dinner.

Ottawa Branch

F. C. C. Lynch, A.E.I.C., Secretary-Treasurer.

Valuation of Public Utilities

Probably one of the most interesting subjects, from the standpoint of the Engineering profession, is the question of the valuation of public utilities. The campaign for public ownership of public utilities, such as railways, light and power systems, street railways, etc., has required the establishment of a basis for arriving at a valuation of these properties.

The Ottawa Branch of *The Engineering Institute*, appreciating this situation, were very fortunate in being able to secure R. A. C. Henry, M.E.I.C., to give a paper on the subject of the valuation of public utilities, on the evening of Thursday March 30th. Mr. Henry was engineer-in-charge of the Grand Trunk Railway arbitration, under the Department of Railways and Canals, which gave him an excellent opportunity to study the subject.

Valuations of public utilities, Mr. Henry said, might be undertaken for various purposes, such as for general public information, for purposes of taxation, to limit capitalization, for purposes of rate-making, for expropriation or sale or purchase, for information for underwriting of securities, or for re-organization purposes.

In any given case the question of how the valuation was to be arrived at arose. Some of the principal bases used to ascertain or test values were as follows:—

(a) Capitalization of net earnings.

(b) Analysis of market quotations of stocks and bonds.

(c) Analysis of original cost to date.

(d) Estimating cost of reproduction new, and cost of reproduction new less depreciation.

A common method of valuing public utilities by bankers, financiers and commercial interests, was by the stock and bond method. Such a method of valuation would necessarily have to be supplemented by an examination of the rights, franchises, physical condition of the property and the accounting methods adopted by the utility in showing the results of operations.

Estimating the cost of reproduction new was a practice that had been resorted to, partly because of the impossibilities in a great many cases of obtaining records which disclosed the actual cost, and partly for the purpose of taking account of any increment in value subsequent to date of construction caused by reason of the development of the tributary territory, or for any other reason.

Referring to depreciation, the speaker said it was a stern cold fact that in the case of every public utility at some time in the future certain or all of its units would cease from one cause or another to function. Failure to appreciate this feature and to provide for the same, was often very disastrous. There was a considerable difference of opinion among engineers and others as to whether or not in a reproduction estimate, anything should be deducted for depreciation. "Going concern" value as distinct from development cost was a value which was placed upon a utility in addition to its bare cost, because the plant was functioning and might be figured more or less in terms of money than the development cost. Mr. Henry quoted a number of important valuations that have been made in the past in the United States and Canada, referring to several valuations which have been made of the Ottawa Electric Railway Company's system.

Major F. D. Burpee, A.E.I.C., in speaking to the subject, gave a brief analysis of the matter as it applied to street railways. In speaking particularly on valuation he said that reproduction costs constituted the basis of value in a normal economic period, and added that profits and dividends were only a small part of the operating costs of a street railway.

Among those who contributed to the discussion were: Messrs. John Murphy, M.E.I.C., electrical engineer for the Department of Railways and Canals; A. Ferguson, M.E.I.C., general assistant engineer, Department of Railways and Canals; Dr. J. G. Rutherford, chairman of the Board of Railway Commissioners; and Mr. Naulan Cauchon, A.M.E.I.C., chairman of the Town Planning Commission.

Engineering and Agriculture

The claim is made by some agriculturists or their would-be friends that "the farmer feeds the world". Without the engineer the farmer could not feed himself. Under present-day living conditions the farmer is dependent upon the engineer, as are all other classes of people.

In the above statement Dr. J. G. Rutherford summed up his address on "Engineering and its Relation to Agriculture", at the monthly luncheon of the Ottawa Branch.

Dr. Rutherford stated that after having had farming experience in eight out of the nine provinces of Canada he had come to the conclusion that the farmer is all right. He is about the sanest kind of a citizen we can have in the country; his capital is invested in land, buildings and live stock, and a man with his all at stake is not usually a dangerous demagogue.

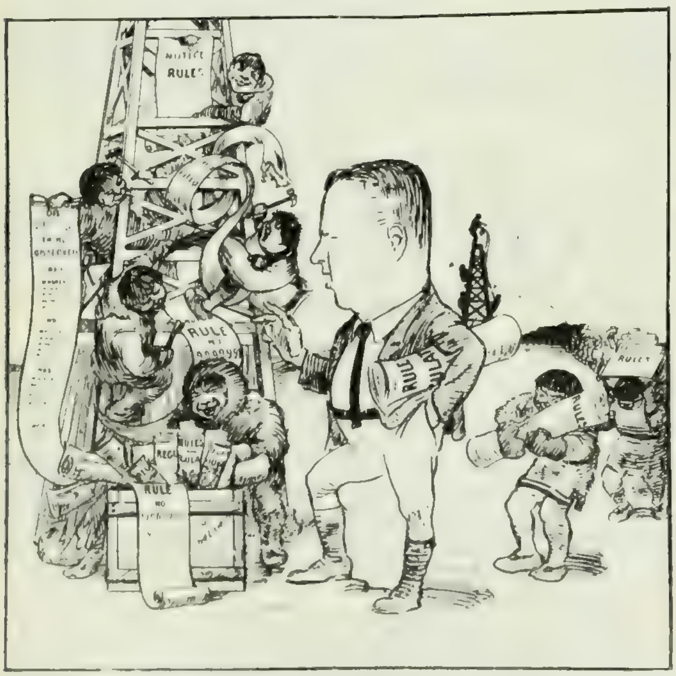
Referring to the demands which are being made for reduced freight rates for farm products, Dr. Rutherford stated there were two classes of demands from farmers, one of these was for the construction of railways at any cost to provide accommodation, regardless of what rates would have to be charged; and the second was from the farmer who had a railway, but now wanted the rates reduced.

The speaker compared the condition of the farmers of to-day with that of the pioneer of the prairies. Unfortunately, the spirit of the pioneer seems to obtain no longer. This, he considered, was the result of the American invasion of the Northwest, which latter was characterized as sheer exploitation. Land had been deliber-

ately worked out, and a yield of thirty-five and forty bushels per acre had been reduced to an average of ten. The real farmer, however, was making a home for himself and is undoubtedly successful. On some farms four grades of buildings may be observed, showing the progress of prosperity from the original log house on the homestead to the comfortable home with every convenience. Referring to the supposed hard times among the farmers of the west, Dr. Rutherford gave some striking illustrations of agricultural financing.

Dr. Rutherford concluded by saying he hoped some day the Railway Commission would be reinstated in the goodwill of the public. They had a difficult role to fill. The railways were necessary to the country and to the farmer, but they had to earn a dividend for the shareholders. The position was simply that the people using the railways had to pay for them. It was not fair to endeavour to make others do it.

K. M. Cameron, M.E.I.C., Chairman of the Branch, presided, and he was supported on both right and left by a strong representation of Members and Deputy Ministers, while seated on his left was Dr. J. H. King, the new Minister of Public Works, who, in a few remarks, said he was glad to meet the engineers in a body, and looked forward to meeting many of them individually in the course of his duties as head of the Public Works Department.



O. S. Finnie, Ruler of the Mackenzie Basin

Montreal Branch

J. L. Busfield, A.M.E.I.C., Secretary-Treasurer.

Montreal Water Works

At the regular meeting of the Branch on March 23rd C. J. DesBaillets, M.E.I.C., Chief Engineer of the Montreal Water Board read a paper describing the engineering features of the recent work carried out by the Water Board of Montreal in connection with the enlargement of the aqueduct. Mr. DesBaillets dealt particularly with the equipment of the new low level pumping station. S. J. Fortin, M.E.I.C., presided.

Electrons and Atoms

On Thursday evening, March 30th, W. B. Cartmel of the Northern Electric Company, gave an address, unique in its nature, dealing with electrons, atoms and the ether. The speaker gave an account of present day ideas as to the nature of electricity and matter, and illustrated his remarks by a number of interesting experiments for which purpose a quantity of electrical apparatus has been installed in the hall. It is hoped that Mr. Cartmel's paper will be published in a future issue of *The Journal*. William C. Adams, M.E.I.C. chief engineer of the Northern Electric Company presided at this meeting.

Submarine Coal Mining

On Thursday, April 7th, F. W. Gray, A.M.E.I.C., dealt with the above subject in a masterly way. Mr. Gray stated that coal has been mined from under the sea since 1872. Eighty percent of the available coal reserves of Cape Breton Island are under the sea, and seventy percent of those of the whole of Nova Scotia. About seventy percent of the coal produced in Nova Scotia at this time comes from under the sea. The furthest distance from shore at which coal is being mined is in the Princess Colliery of the Nova Scotia Steel and Coal Company at Sydney Mines, where the face of the main deeps is 2¼ miles from shore. At many other points coal is being worked at distances exceeding one mile from shore under a thickness of strata lying between the coal seam and the sea bottom ranging up to 1,400 feet.

The only important difference between mining coal from under the land and from under the sea is the danger of inundation from the sea, and the chief necessity imposed upon the mining engineer is to prevent breaking and distortion of the strata lying above the coal seams. This necessitates accurate knowledge of thickness of strata, and soundings to show the contour of the sea floor. The nature of the strata is important, an advantage being the existence of impervious clays and rocks possessing some elasticity. Pockets in the sea floor, the existence of old beaches and dislocation of strata are important matters of knowledge and record. Absence of landmarks, and necessity to carry survey lines from tie points on shore, required surveying of great accuracy.

Mine inundations from the sea have not been numerous, and have not, with one possible exception at Takashima Colliery in Japan, been accompanied by great loss of life. An accident occurred on the Cumberland coast of England in 1834, where 36 men were drowned by letting in the sea as a result of the foolish action of an incompetent manager. In Nova Scotia two inundations have taken place, each unaccompanied by loss of life, one at Ford Hood Colliery and one at Mabou Colliery, both in the Inverness field of Cape Breton. The flooding of Mamou Colliery was a result of poor judgment and incompetent mining. The flooding of Port Hood has never been satisfactorily explained, as where water entered there was vertical strata cover of 940 feet, and it is extremely improbable that water could have entered from the sea through a vertical crack of this extent.

The problems of mining under the sea are many and serious. The great problem in the Nova Scotia fields is the transmission of power underground for long distances from the point of entrance, and the forcing of fresh air through many miles of underground passages. The taking of workmen to and from the working face each day will become a question of much importance when workings extend four or five miles seawards, or even greater distances as is not an unlikely possibility of the future.

Mr. Gray showed a unique series of photographs to illustrate the rapidity with which the carboniferous strata of Cape Breton is being eroded by the sea. The photograph showed the wasting of what was formerly a prominent sandstone spur on the coast near Glace Bay, taken at intervals over 21 years, during which time the spur has been gradually disappearing.

John T. Farmer, M.E.I.C., presided at this meeting.

Carrier Current Telephony

On Thursday, April 13th, H. J. Vennes, transmission engineer of the Northern Electric Company, gave a very interesting description, illustrated by lantern slides and special apparatus, of the modern system of transmitting telephone messages by means of carrier currents, with special reference to the installation between Edmonton and Calgary. Great interest was displayed in this paper and there was considerable discussion.

Professor C. V. Christie presided.

Meeting of Electrical Engineers

On Wednesday evening, March 29th, a number of electrical engineers and officers of the Montreal Branch gathered together at an informal dinner at the University Club and discussed the general situation regarding the representation of electrical engineers in the Montreal Branch. The advisability of creating new sections of the Branch was discussed but it was finally decided that no change should be made in the present Branch organization, but that the scope of the electrical section should be widened so as to insure the proper representation of electro-physical, communication and radio engineers. It was decided that it might be desirable to occasionally hold meetings on other evenings than Thursdays at which very special electrical papers of a highly technical nature might be presented for discussion.

Quebec Branch

Hector Cimon, A.M.E.I.C., Secretary-Treasurer.

There was a well attended meeting of this Branch held in the "green room" at the Chateau Frontenac on Monday evening, March 27th., when very instructive and interesting lectures were delivered by Arthur Fournier, A.M.E.I.C., managing director of Pruneau and Company, Limited, of Quebec and by Olivier Lefebvre, M.E.I.C., chief engineer of the Quebec Streams Commission.

Coal Tar Industry

Mr. Fournier, who spoke in English, took as his subject "Coal Tar Industry" and his discourse of a technical nature was ably prepared and well delivered.

In the beginning of his address, he dealt with the various by-products of coal, but concentrated his remarks in the main on the production of coal tar. He covered this industry in its various stages up to the present day, describing the different kinds of tar produced, the methods employed to produce it, the blending process and the use to which these products are put. In the last part of his address, he spoke of road tars and gave a detailed description of the way in which these tars are made and how and where they are used.

Mr. Fournier was heartily applauded as he concluded and was particularly congratulated on the fluent manner in which he delivered his address in English.

The Gouin Dam

Mr. Lefebvre's address was on the "Gouin Dam", on St. Maurice river, and was illustrated with lantern slides showing plans of the dam and also with moving pictures of these famous storage works.

The speaker touched at length upon the features of the dam which he described as a "Concrete monument to the genius of man," and paid a high tribute to the acumen of the late Hon. S. N. Parent, the first president of the Commission.

He explained in detail the construction of the immense storage plant and showed how it operated. This dam, he said, would stand an ice pressure of 50,000 lbs. per foot, but strangely enough no ice had formed within a hundred feet of the gates.

The Quebec Government paid for the huge dam and was being reimbursed by the companies which benefitted by the use of the stored water. They paid interest on the capital invested as well as a sinking fund over a period of 40 years and the cost of operation. The revenue from the dam was now $210,000 but would eventually attain $400,000 when all the water powers on the river had been developed.

Mr. Lefebvre also gave account of the present developments on the St. Maurice river and outlined the possibilities of the future developments. He foresaw the production of one million horse power on that great water course.

The meeting was presided over by Chairman A. R. Décary who introduced the speakers and also thanked them most cordially for their very interesting lectures.

Joffre Terminals, Levis Division, C.N.R.

Joffre Terminals, formerly known as Chaudière Junction, as a freight terminal for the district of Quebec was the theme of a very interesting address delivered by J. E. Gibault, A.M.E.I.C., division engineer, C.N.Rys. Levis, before the members of this Branch at their monthly luncheon-meeting, which took place at the Chateau Frontenac, April 10th.

The speaker stated that this terminal was the most important out of the seven terminals in the district of Quebec and, perhaps, one of the most important in the whole of the Dominion of Canada. It supplied some six hundred and thirty miles of railroad territory with freightage which originated at this point. Thirty-five trains per day were dispatched from that centre.

Mr. Gibault fully described all the facilities which

are to be found at Joffre and with which it is now possible to handle considerable freight with 35 men. He said that $300,000 had been spent for adequate facilities and that, among those, was a series of 68 sidings with a total capacity of 1,452 cars.

Alex. Larivière, A.M.E.I.C., at the conclusion of this address moved a vote of thanks to the speaker saying that the members present, besides being very much interested as engineers were still more interested, as citizens of this country, in knowing what was being done on our C.N.Rys., and that they were very pleased to hear Mr. Gibault talk of his division and of the whole system in such an optimistic manner.

Chairman A. R. Décary, who had presided at the meeting, added a few words and suggested that a visit to Joffre Terminals be arranged to take place shortly. The suggestion met with complete approval and the visit will, no doubt, be much appreciated.

Historical Sketch

A short historical sketch of this Branch, of its formation and past activities, will, no doubt, be of interest to our members.

Looking backward through the annual reports of the Canadian Society of Civil Engineers, now *The Engineering Institute of Canada,* we find that the formation of Branches throughout Canada resulted from a resolution of the Annual meeting of 1904, which reads as follows:—"That the Council be instructed to consider with as little delay as possible the establishment of Branches of this Society in the large centres in Canada, and be authorized to provide the financial aid necessary to establish and maintain such Branches."

In 1904, some work was done towards the formation of a Branch in Toronto.

In 1905, a Branch was formed at Sydney, the establishment of a branch in Ottawa was being taken into consideration and no final action was reached with regard to the Toronto Branch.

In 1906, the Sydney Branch is in operation, the Toronto Branch is formed, members in Manitoba contemplate the formation of a Branch at Winnipeg and an application from Quebec is filed at Headquarters. In 1907, Branches are formed at Quebec and Winnipeg and, in 1908, we find in full operation:—Toronto, Quebec and Winnipeg. The Sydney Branch, unfortunately, no longer exists. In 1914, there were 9 Branches from coast to coast, while, today, *The Institute*'s family numbers 22 strong and healthy Branches.

The Quebec Branch is one of the three oldest Branches. The petition for the establishment of a Branch in Quebec was signed by 31 engineers of Quebec and vicinity, 16 of whom are still active members of this Branch. The first regular meeting was held on January 17th, 1907 and the first Executive Committee included the following gentlemen:—

President, E. A. Hoare; Secretary-treasurer, P. E. Parent; Assistant-secretary, Hugh O'Donnell; Councillors: A. R. Decary, J. M. McCarthy, St. Geo. Boswell.

During the first years of its existence, the Quebec Branch found it fairly difficult to get financial aid from Headquarters and the local members gallantly pledged themselves for a voluntary subscription to the Branch fund.

The total membership of the Branch, at the end of 1907, was 42; to-day, it is nearly 100 and the Branch has also a number of friends who might become Associates.

The past presidents were:—
1907-1908: — E. A. Hoare,
1909: — L. A. Vallée,
1910: — A. E. Doucet,
1911: — P. E. Parent,
1912: — W. D. Baillargé,
1913: — A. R. Décary,
1914: — Arthur Amos,
1915: — S. S. Oliver,
1916-1917-1918: — A. E. Doucet,
1919-1920-1921: — A. R. Décary.

Reviewing the activities of this Branch, a few words must be said about our regulations or by-laws.

Among the many by-laws or rules which this Branch adopted or suggested to Headquarters during its stage of organization, the following are worth noting since some of them have been discussed lately by other Branches.

Quorum at all meetings to be 5; (1908)

Two meetings to be held each month; (1908)

Annual meeting to take place in third week of January this was changed to first week of May, last year;

This Branch to have jurisdiction and include all members of the Society from Three-Rivers to the East Boundary of the Province of Quebec; (1909)

Headquarters to seek recommendation from Executive of Branch before admitting a new member; (1909)

Of the services performed or the important resolutions passed by this Branch in connection with professional matters, etc., are to be mentioned:—

1908, the Q.L.S. Bill;

1909, Tariff of fees for professional services; Forest protection against fires: this resolution was brought to the attention of the Prime Minister.

1912, Enactment of laws in all provinces similar to those then existing in Quebec and Manitoba; this resolution was brought to the attention of Council; Formation of a Committee on Steel Bridges Specifications;

1918, Formation of a permanent Committee on Legislation; the Quebec & Atlantic Ry. Bill; Amendments to the Quebec Act; (penalty clause) List of recognized schools of Engineering submitted to Council;

1919, Considerable attention is given the Provincial Division or Corporation of Professional Engineers of P.Q.; the Stationary Engineers Bill; Formation of an Employment Committee for returned soldiers;

1920, Formation of a Special Committee on Classification and Remuneration of Engineers;

1921, the Forestry Engineers Bill;

May it also be pointed out that, during the Great War, namely in 1914 and in 1917, this Branch subscribed over $300.00 to the Patriotic Fund and the Red Cross.

Now, as to the lectures on engineering topics given before this Branch, we have had:—

1909:—"Aids to navigation between Quebec and

Belle Ile" by P. E. Parent, Esq., A.M.E.I.C.

"Forestry Preservation" by R. O. Sweesey, Esq., followed by comments by Prof. Gagné of the Toronto University.

1912:—Water-Powers by R. O. Sweesey, Esq.

1913:—"Les bons chemins" par Mr Gabriel Henry, A.M.E.I.C.

"A paper on the Quebec Bridge" by E. A. Hoare, Esq., M.E.I.C.

1014:—"La mise en œuvre des chûtes d'eau et les prix de revient comparatifs dans divers pays" par Arthur Surveyer, Ecr., M.E.I.C.,

"Cast Iron vs Steel mains for water supply" by T. A. J. Forrester, Esq., A.M.E.I.C.

1916:—"Munitions" by M. Wolff, Esq.

1917:—"Chaudière River Flood, July 31st. 1917" by E. A. Evans, Esq., M.E.I.C.

1921:—"Recent developments in Concrete" by Col. Boyden of the Portland Cement Association of Chicago.

The above only mentions some of the most salient features of the work performed by this Branch in the past. It says nothing of what the present Executive Committee is trying to do to serve our members in the best way possible to make our meetings interesting and to enhance the usefulness of the profession to the public.

Let us state, before concluding that this Branch held 118 general meetings and 47 executive meetings or a total of 165 from 1907 to the end of 1921, which may give a fairly good idea of the work performed.

Now, let us add a few words about our Chairman, A. R. Décary. He was one of our Founder Members, he was appointed a Councillor of this Branch in 1907 and. ever since, he has been on the Executive Committee, No one has been more closely connected with this Branch and to state that our minute-books give him credit for having attended 131 out of 165 meetings, that is 80% in 15 years, since the formation of this Branch, is enough, as one may believe, to make everyone realize the immense services he rendered this Branch and *The Institute*. We are grateful to him for his clever management of our Branch affairs and we appreciate all he has done towards promoting our professional interests".

Read by the local secretary at the Regular Meeting of the Quebec Branch, held at the Chateau Frontenac, 27th, 1922.

St. John Branch

Harry F. Bennett, A.M.E.I.C., Secretary-Treasurer.

Further results of the tests of concrete in sea water being carried out in St. John harbour by the Dominion Department of Public Works in conjunction with the St. John Branch of *The Engineering Institute of Canada* were described in a paper on the subject read before the St. John Branch on April 20th, by A. G. Tapley, A.M.E.I.C.

These tests were started in 1920 and additional test blocks were placed during 1921. The results shown are not yet conclusive, and, while a few of the blocks are standing up, it cannot be definitely stated that a mixture has been obtained which can be used with safety.

Observations of the older specimens show that during the summer season the disintegration was not apparent, but with the advent of winter it is rapid and very apparent. The blocks which were of a wet consistency are found to disintegrate most rapidly, and when the outer protecting skin is broken the body of the block offers little resistance. Of the specimens which show no disintegration after two years, the proportions of the mixture were 1—1½—3 and 1—2—4. The better blocks were allowed to set in air from seven to eight days after casting. A longer set in air does not seem to add to the resistance of the concrete.

During 1921 further test blocks were made under conditions similar to concrete construction in St. John harbour. One block was also made by the Canada Lock Joint Pipe Company, Ltd., of a mixture similar to that used in the lock joint pipe for the West St. John water main, this block set in air three months. In the 1921 tests, various ingredients were added to the different blocks, such as kerosene oil, pine tar, crude oil, powdered alum, gypsum, barium chloride, acetate of copper, raw sugar, infusorial earth, ochre, sodium silicate and toxement. Some of these have shown signs of deterioration even in one winter and another season will prove the advisability of using any of these ingredients.

The paper was splendidly illustrated by lantern slides and charts. At the conclusion of the paper, Major C. F. Draper, M.E.I.C., in discussing the subject, stated that he was disappointed that no definite results had been obtained, but the tests had shown the necessity for the greatest care in the manufacture and placing of any concrete in sea water. The nature of the tests had been varied and he congratulated Mr. Tapley on his work.

Alex. Gray, M.E.I.C., said he felt that the results had impressed him with the fact that the chemical composition of the ingredients was a large, and probably the governing, factor in the development of a sea water resisting concrete. The good blocks obtained were little different from some which had disintegrated and we must find the cause.

A vote of thanks was extended to Mr. Tapley by F. P. Vaughan, M.E.I.C., Chairman of the Branch.

A party from the St. John Branch visited the Traffic Department of the Western Union Telegraph Company at St. John on Saturday, March 18th. The various features of the equipment and methods of operation were explained by J. M. Wilson, superintendent of the department. The members were very glad to have the opportunity of visiting the plant.

The last of the "Seeing St. John" visits of the Branch was made on April 22nd to the plant of the N. B. Telephone Co., Ltd. Through the courtesy of F. J. Nesbit, exchange manager, and W. R. Pearce, M.E.I.C., chief engineer, the party was led through the intricacies of the telephone operation and were much impressed with the development of the system. The Branch is indebted to the company for this opportunity.

Cape Breton Branch

Kenneth G. Cameron, A.M.E.I.C., Secretary-Treasurer.

The Operation and Equipment of the Iron Ore Mines at Bell Island, Newfoundland

A regular monthly meeting of the Branch was held March 9th, when S. C. Mifflen, B.Sc., A.M.E.I.C., read

an excellent paper on the above subject. The paper was illustrated by a variety of photographs and also, through the courtesy of the Maritime Motion Picture Company, by a reel of films which showed actual operations, and put the finishing touches to the description.

Dinner and Social

On March 23rd, a most successful dinner and smoker was held at the Norfolk Hotel, Sydney. The Chairman of the Branch, C. M. Odell, M.E.I.C., presided, Geo. D. Macdougall, M.E.I.C., and E. C. Hanrahan, president and secretary respectively of the Nova Scotia Mining Society, were guests.

The evening's arrangements were made by A. W. McMaster, A.M.E.I.C., and W. S. Wilson, A.M.E.I.C., and the unqualified success was a tribute to their organization. The intervals during the meal and subsequent intervals were filled in by choruses from the Rotary Club song books, in a manner which belied the engineers' reputation for silence and incapability of expression.

After the dinner those members who were accompanied by friends were asked to introduce them to the company. The Chairman then conveyed regrets and good wishes from North Sydney members who were unable to be present.

Mr. Odell, continuing, gave an account of the origin of the Canadian Society of Civil Engineers, tracing engineering work back as far as the early exploration work of Alec. Mackenzie and Simon Fraser, whose tracks were followed a hundred years later by the preliminary surveys of the Western lines. He pointed out that the splendid work done by these pioneers had not at the time received its due recognition, even their burial place being forgotten.

Such incidents as these had caused that agitation for recognition which resulted in the founding of the Canadian Society of Civil Engineers in 1887. The subsequent developments of the Society, its recent change of name, and the greatly increased activity of late years have resulted in its now occupying a prominent national position. Mr. Odell again emphasized the immense advantages which membership brought to the younger members, and urged one and all to take the keenest interest, attend all meetings, prepare papers, contribute to the discussions, and take part in the social gatherings.

Mr. E. C. Hanrahan complimented the Branch on its progress to date since its organization, and on the enthusiasm and success of the evening. As a Cape Breton resident of long standing, he told of the early engineering works in the Sydney district, the scepticism with which early efforts were greeted, and the coming of the I.C.R.

Mr. Macdougall, M.E.I.C., chief engineer of the British Empire Steel Corporation, endorsed the Chairman's remarks in regard to the value of *The Institute* as a body, adding that he had been a member for twenty-one years.

In defining the term "Engineer", as one who controls and uses the arts and materials of nature for the benefit of mankind, he spoke of the early work, largely military, and the enormous developments and wonderful ramifications which it has lead to at the present day. Paying tribute to the great men who have been associated with the Society and *The Institute*, he made special mention of one who, for twenty-five years, was Secretary and who was a native of Cape Breton and his maternal uncle, Professor C. H. MacLeod.

The works of these prominent engineers were to be found all over Canada and formed a record of which the profession might well be proud. The real pleasure and satisfaction of the young engineer was derived from the fact of diligent work and the giving of the best that was in him. Work carried out in that spirit could not fail to bring success.

The Chairman, speaking further of the work of the profession, quoted from the tomb of Sir Christopher Wren in St. Paul's Cathedral London,— "If you would see his monument, — look around".

The feature of an excellent programme which followed was a sketch by Dan Ross on "Scientific Impressions of Modern Transportation". Mr. Ross, in the character of a backwoods rube of the early Cape Breton days, kept his audience convulsed for over half an hour describing his trip to Boston and his adventures there.

The Mechanical Working of Iron and Steel

At a regular monthly meeting held May 4th., an illustrated paper on the above subject was read by I. W. Buckley, A.M.E.I.C., assistant superintendent of mills for the Dominion Iron and Steel Company.

The author showed how iron and steel are worked in the three different processes of hammering, pressing and rolling, giving a brief description of each process. Incidentally he mentioned that the rolling mill was invented by Henry Cort, who was born at Lancaster, England, as long ago as 1783. The same man invented the puddling process of making iron.

The heating and furnace treatment of the steel was gone into thoroughly, and the way in which steel has supplanted iron in its many uses, was well shown by special curves, which were very interesting. Taking iron and steel rails rolled at different periods, previous to 187[illegible] more iron than steel rails were rolled, and after 189[illegible] very few iron rails were produced, whereas the production of steel rails increased yearly, until in 1907 there were 3,632,729 gross tons of steel rails rolled. Of interest also was a chart showing the relation of open hearth and Bessemer rails. Bessemer tonnage has declined rapidly since 1907, while in 1913, there were over two and a half million tons of open hearth material produced.

Mr. Buckley gave a detailed description of various types of rolling mills, drawing attention to special points in their design, and operation. This part of his paper was covered by a large number of specially prepared charts and drawings.

He concluded by quoting from Henry David Hubbard's writings, with reference to steel.

I am Steel.
I am forged into factories, spun into railroads, and woven into cities.
I make man strong of arm, swift of foot, and a miracle worker.
I scoop out harbours, span rivers and oceans, move mountains, and toss them into the sea.
My arms, tireless, strong, skilled beyond dreaming, set men free.

My power to serve is boundless, for in me pulsates cosmic energy.
In soldier's hands, I carve the way to freedom.
With the surgeons, I cut the way to health.
With the worker I build civilization.
I take man's puny crafts, one by one, and make them all vast enterprises.
I am Steel.
Man is my master.
I am his Master's servant.
I await his commands to create new eras.

Transfer of Members to Other Discricts

During the past few months, the following changes of membership have occurred.—

C. L. Cantley, A.M.E.I.C., has returned to New Glasgow from Sydney.

J. F. F. MacKenzie, Jr.E.I.C. is now with the Dominion Bridge Co., Lachine, Que.

J. L. Underhill, Jr.E.I.C., has left the Nova Scotia Steel and Coal Co., and is now resident in the States.

Nova Scotia Act Governing Steam Boilers.

Welcome evidence of the awakening recognition of the Professional Engineer by the Public is given by the action of the Minister of Public Works and Mines for Nova Scotia, who has sought the cooperation of the Association of Professional Engineers of Nova Scotia in the matter of putting into force an Act governing the design, construction, and inspection of steam boilers. The Association, at a Council meeting held April 6th., recommended that this matter be deferred to the Nova Scotia Branches of *The Institute.*

The Executive Committee of the Cape Breton Branch, at a special meeting held April 12th., to consider this matter, concurred in the resolution forwarded by the Council of the Association, and recommended to the Minister of Public Works that D. W. Robb, M.E.I.C., of Amherts, W. G. Matheson, M.E.I.C. of New Glasgow, and J. H. Fraser, A.M.E.I.C., of Sydney, would form a suitable committee to deal with this matter.

Halifax Branch

O. S. Cox, A.M.E.I.C., Secretary-Treasurer.

The regular monthly meeting of the Halifax Branch was held in the Green Lantern at 6.15 P.M. March 29th, Chairman C. E. W. Dodwell, presiding. Number present 35. After an informal supper the business of the meeting was proceeded with. Nominations were asked for members of the Nominating Committee for the ensuing year and the following were nominated:—D. W. Robb, M.E.I.C.; C. A. Fowler, A.M.E.I.C.; F. W. W. Doane, M.E.I.C.; J. W. Roland, M.E.I.C.; F. R. Faulkner, M.E.I.C.; K. H. Smith, M.E.I.C.

W. G. Hardy, M.E.I.C., then presented a paper on Engineering Underground in France. R. R. Murray, A.M.E.I.C., was to have given a paper on this subject but as he was unable to be present, Mr. Hardy read Mr. Murray's paper and supplemented it with accounts of operations from his own experiences in similar lines of military engineering. The paper dealt with various methods and types of construction employed in shaft sinking, tunnelling and dugouts with detailed accounts of actual operations in which Messrs. Hardy and Murray took part, including the placing and blowing of some of the largest mines used on the Western front during the war. The speaker traced the great development of this phase of warfare during the late war, showing in contrast the extent of the mining operations in the early part of the war and that developed before its close. This very interesting and instructive paper showed what is little realized by most people, the very important part played by the Engineer in the great war. Extensive accounts have been written and many books published, dealing with the engagements taken part in and the victories won by the infantry, artillery and other units, while scarcely more than passing notice has, in many cases, been given to the Engineers who prepared the way and made these victories possible. Mr. Hardy's paper was supplemented by lantern slides, maps and plans of actual operations carried on at the front. At the close of the paper, Mr. Hardy was extended the hearty thanks of the Branch.

Town Planning Notes and Comments

Horace L. Seymour, A.M.E.I.C.

NOTE. — *In order to make this column of wide interest to members of The Institute, personals and items of town planning interest will be appreciated. Address: Horace L. Seymour, A.M.E.I.C., 40 Jarvis Street, Toronto.*

Town Planning and Current Periodicals

There are certain magazines that are devoted entirely, or at least primarily, to the interest of town planning in its various phases. A list of such magazines would include the "Town Planning Review", and "Garden Cities and Town Planning" published in England;" Landscape Architecture," "The American City" published in the United States and the "Journal of the Town Planning Institute of Canada" published in this country.

Apart from these magazines, it is significant to note the attention that is being paid in current engineering and other periodicals to the subject of town and city planning.

The Saturday Evening Post—Those interested in problems of town planning are strongly recommended to read the article "Your Town Tomorrow" by James H. Collins, that appears in the April 1st., issue of the Saturday Evening Post. Mr. Collins deals particularly with the matter of traffic and forces home the fact that it is the automobile that is going to alter our cities. "Speed limits on the automobile are a paradox" he quotes. "The automobile is designed to run fast. That is its whole function, attraction and service. Limit it, and you lose all its benefits. Speed limits and traffic control have become necessary because we have not yet learned to separate the automobile from slower traffic, and give it highways of its own."

Mr. Collins sees that there must be a sorting out of the different kinds of traffic and that new channels must be provided for the different kinds. "Street cars, automobiles, motor-trucks, horse vehicles and pedestrians must be separated and given their own right-of-way where none can hamper or endanger the others." He forecasts the disappearance of the surface car and the provision of overhead and underground means of travel for the automobile.

Another suggestion is for automobile highways between large cities, so located that, they bypass the important streets of intermediate towns and villages.

Engineering News-Record.—In the February 16th issue of this magazine there is a review of the biography, "Daniel H. Burnham, architect, Planner of Cities," under the caption "A Great Architect and City Planner."

Mr. Burnham's famous injunction, formulated in 1907 and well-known to town and city planners, should be known by every city engineer:

"Make no little plans; they have no magic to stir men's blood and probably themselves will never be realized. Make big plans; aim high in hope and work, remembering that a noble, logical diagram once recorded will never die, but long after we are gone will be a living thing, asserting itself with ever-growing insistency. Remember that our sons and grandsons are going to do things, that would stagger us. Let your watchword be order and your beacon beauty."

Engineers and Engineering.—The February issue of Engineers and Engineering, a monthly magazine published by the Engineers' Club at Philadelphia, is devoted almost entirely to zoning. It includes an article on the "Proposed Zoning Ordinance for Philadelphia" by local city officials; an address on "Zoning" by the Hon. Edward M. Bassett, the counsel for the Zoning Committee, New York City; "The Relation of City Planning and Zoning to the Selection of Type of Pavement" by Jefferson C. Grinnalds, secretary of the Zoning Commission, Baltimore, and also assistant engineer to City Plan Committee.

Every engineer interested in zoning and city planning should add this February number to his library.

The Ottawa Journal.—In connection with the Ontario "Deferred Widening Bill" the Ottawa Journal on April 4th., under the caption "A Desirable Measure" stated editorially in part as follows:

"A bill is now before the Ontario Legislature aiming at the removal of a disability from which nearly all Canadian cities have suffered—the difficulty of taking preparatory measures for the widening or extension of streets in advance of the time when such work may be properly commenced, to the end that new buildings in a street to be widened or extended may not be so erected as to obstruct or make more costly the work of improvement when it is undertaken."

"The Bill now before the Legislature aims to supply it. It provides that a municipal bylaw for establishing, or extending, or widening a highway or part of a highway may specify that the corporation shall not enter immediately upon the land required to be taken for such purpose or purposes to proceed to carry out the work, but that entry on the land and the commencement of the work shall be delayed until a day named in the bylaw, which shall be not less than three years, nor more than fifteen years after the passing of the bylaw."

"In the matter of compensation the value of the land to be taken is to be fixed as of the date of the bylaw (or of filing of advanced plan) and while the Corporation (or the owner) might proceed at once after the passing of the bylaw to have the compensation fixed, it would not be payable until the date of entry."

National Municipal Review.—This magazine should probably have been included in the list of those published in United States that deal, in part at least, with town planning, as [amongst other organizations serves the National City Planning Conference.

The March issue includes an article "Zoning Chicago" by E. H. Bennett, Director of Zoning Work for the city of Chicago. Mr. Bennett gives some idea of the field surveys necessary for the preparation of zoning study maps, which should be of value to engineers interested in zoning. Mr. Bennett estimates that approximately one billion dollars has been spent in building development in the last ten years in Chicago, on industry, business and housing construction. The total expenditure in the thirty years just past, is estimated at five billion dollars.

"The sum total of saving that can be achieved by reason of regulated growth and resultant preservation of values and creation of new values, etc., in this period—or in one generation—it is safe to estimate at not less than one-fifth of this sum, or $1,000,000,000!"

CORRESPONDENCE

Editor, *Journal*:— April 8th, 1922.

Dear Sir,

In *The Journal* for April, 1922, page 205, I have noticed an announcement of the price at which the publications of this Society may be purchased. I am sorry to say that the prices quoted are in error and should be as follows:—

	Rate to Members	Rate to Non-Members
"Proceedings", single copies...	$ .50	1.00
Per year....................	No charge	8.00*
"Transactions", per year.....	No charge	12.00†

*If subscription is received before January 1st, otherwise $10.00

†If received before February 1st, otherwise price is $16.00.

These publications may be purchased by members of *The Engineering Institute of Canada* at a discount of 50% from the non-member rate.

Yours very truly,

(Signed) ELBERT M. CHANDLER

Acting Secretary.

American Society of Civil Engineers,
29 West 39th Street, New York, N.Y.

Triangulation Data

Editor, *Journal*:— Ottawa, March 18th, 1922

Dear Sir:

It has occurred to me that most engineers have not in convenient form for calculation, formulae for use in connecting up surveys with triangulation. With this in mind, I have compiled a series of examples of the following problems:—

1. *Determination of Latitude and Longitude*, when the length and azimuth are given.

2. *Determination of Length and Azimuth* of fixed lines, when the latitude and longitude of each end of the line is given.

3. *Determination of Plane Rectangular Co-ordinates* from geographic co-ordinates.

4. *Determination of Latitude and Departures*, adjustments, in inverse solution.

These examples are based upon the latest and best geodetic formulae recently derived by W. Maxwell Tobey which have not yet been published but are in the press at present. They are arranged together with the explanation and the necessary tables in eight sections, which will take up one leaf or two opposite pages of space in *The Journal.* The idea is to have the dividing lines of the sections exactly coincide with each other, so that an engineer can cut the page out of *The Journal* and then cut it along the dividing lines into four pieces, each forming the leaf of a small book, which can then be pasted together and slipped inside of a log book for future reference.

The idea was brought to my mind by one of our Ontario city engineers who wished to get the distance and azimuth between two points of which he had the latitude and longitude only. He set two of his assistants to work it out and it took them two days, and then they were not sure that they were right. If they had had the information I am supplying they could have had the information in fifteen minutes and would have been sure that it was correct.

Yours sincerely,

DOUGLAS H. NELLES, M.E.I.C.

Supervisor of Topography.

Page 1

THE DETERMINATION OF GEODETIC POSITIONS, LENGTHS & AZIMUTHS
by
Douglas H. Nelles, M.E.I.C

The following formulae and tables have been derived and arranged for calculation by W.M.Tobey M.A.,D.T.S.,M.E.I.C. Senior Geodetic Engineer, Geodetic Survey of Canada, with the exception of page 4&5. For the derivation of formulae and fuller explanation see Geodetic Survey of Canada Publication No.7.

When an engineer graduates from the university he generally specializes in some one line of engineering. In furture years he sometimes comes across a problem in another line, needing formulae that he has forgotten,or at any rate has not in a ready shape for calculation. This article gives in an accessable form the latest and best methods of calculating geodetic and plane co-ordinates. They are so arranged that this page of the Journal can be cut out and cut up into four leaves making a small book for the engineer to place inside the cover of his regular book of tables, for ready reference.

Page 2 contains a form for calculating the Latitude and Longitude of a point, when given the distance and azimuth from another point whose Latitude and Longitute is known. No directions are necessary for this calculation as all that it is necessary to do is to follow the numbers of the operation column. The values for the various terms will be found in the tables on pages 6, 7 & 8.

Page 3 contains a form for calculating the length and azimuth of fixed lines, when the latitudes and longitudes of the two points at each end of the line is known.

Page 5 contains a form for calculation of Latitude and Departures and for calculating corrections to the latitudes, departures, lengths and bearings of a traverse when the line closes upon itself or is run between two fixed points, such as triangulation stations.

Page 4 contains a form for the determination of the plane co-ordinates between two points when the Geodetic co-ordinates are given. The formula was derived by Walter F.Reynolds of the U S Coast & Geodetic Survey. The accuracy of the results can be obtained by comparison with the other calculations, as the same line has been used for each. Sometimes it is desired to base the system of latitude and departure co-ordinates upon a line that makes an angle to the meridian passing through the zero point. Operations 20 to 25 show this calculation for an angle of 30 degrees.

Pages 6,7 & 8 contain tables for use in the calculations on pages 2 and 3.

The following publications of the Geodetic Survey of Canada may be obtained by application to the Director at Ottawa, Ont.

- No.1. Precise Levelling, Certain lines in Ontario, Que. & B.C.
- No.2. Adjustment of Geodetic Triangulation in Ontario & Quebec
- No.3. Determination of the Lengths of Invar Base Line Tapes from Standard Nickel Bar No 10233
- No.4. Precise Levelling Certain in Ontario and Quebec.
- No.5. Field Instructions to Geodetic Engineers in Charge of Direction Measurement on Primary Triangulation
- No.6. Precise Levelling Certain Lines in Manitoba and Saskatchewan
- No.7. Geodetic Position Evaluation.
- No.8. Field Instructions for Precise Levelling
- No.9. The Making of Topographical Surveys of Cities and Towns, The First Step in Town Planning

Page 3.

DETERMINATION OF LENGTH AND AZIMUTH OF FIXED LINES

Line from 1 Victoria Tower ....to 2..R269..........

Calculated by.. DHN Date..19-1-14....Checked by....GSR.....Date..20-1-14......

λ_1 = 75 42 00.255 ϕ_1 = 45 25 29.443

λ_2 = 75 43 24.298 ϕ_2 = 45 25 28.758

$\lambda_1 - \lambda_2$ = 1 24.043 $\phi_1 - \phi_2$ = 0.685

$\phi_m = \frac{1}{2}(\phi_1 + \phi_2)$ = 45 25 29.100

Operation	Term	Value	Logarithms
1	Sin.1"		4.6855749
2	$R\phi_1$		6.8019402
3	$\phi_1 - \phi_2$		9.8358761
1+2+3=4	d.Cos.α		1.3254412
16	Cos.α		8.0636502
4-16=17	d	Metres 1827.22	3.2617910
18			0.5159838
17+18=19		Feet.. 5994.861	3.7777748
5	$\lambda_1 - \lambda_2$		1.9244777
1	Sin.1"		4.6855749
6	$N\phi_2$		6.8054456
7	Cos.ϕ_m		9.8462415
5+1+6+7=9	d Sin α		1.2617617
4	d Cos α		1.3254412
9-4=?	Tan α	269 20' 11.8	1.9363205
½(11)=12	½(Δα)	29.9	
α+12=13	α_2	269 20 41.7	
α+180=14		89 20 11.8	
12	½(Δα)	29.9	
14+12=15	α_1	89 19 41.9	
5	$\lambda_1 - \lambda_2$		1.9244777
10	Sin.ϕ_m		9.8526308
5+10=11	Δα	59.866	1.7771795

λ = Longitude
φ = Latitude
R = Radius of Curvature
N = Normal
α = Azimuth
Δ = Difference

Page 5.

COMPUTATION OF LATITUDE AND DEPARTURES

Line Gatineau Valley Traverse Computed by DHN Date 3-1-14
Run by GSR Checked by ITD Date 3-1-14

V.Tow.-R269
9.9999716
3.7777747
3.7777463
5994.49

5.6582933
3.7777747
1.6360680
43.56

COMPUTATION OF LATITUDE AND DEPARTURES CORRECTIONS

V.Tow.-R269

3.7777463
1.6360680
2.1416783
269-20-41.9

3.7777463
9.9999716
3.7777747
5994.89ft.

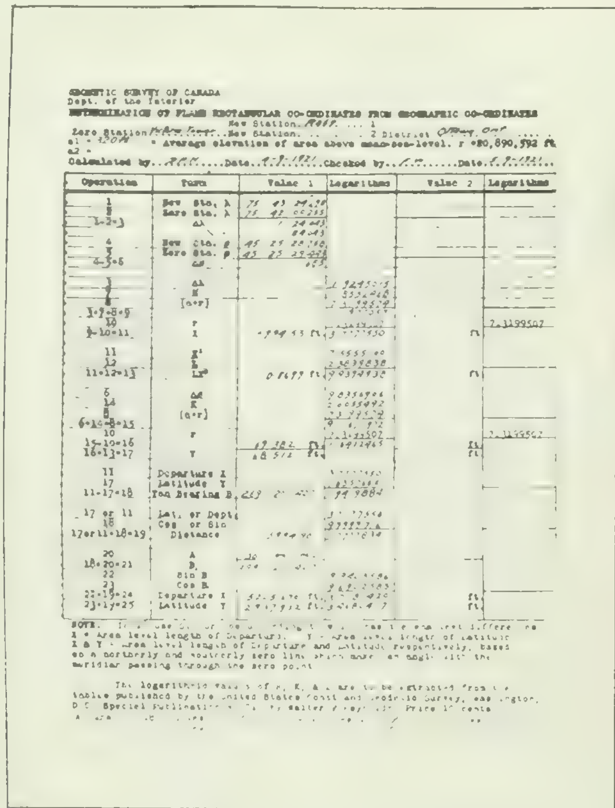
Page 7.

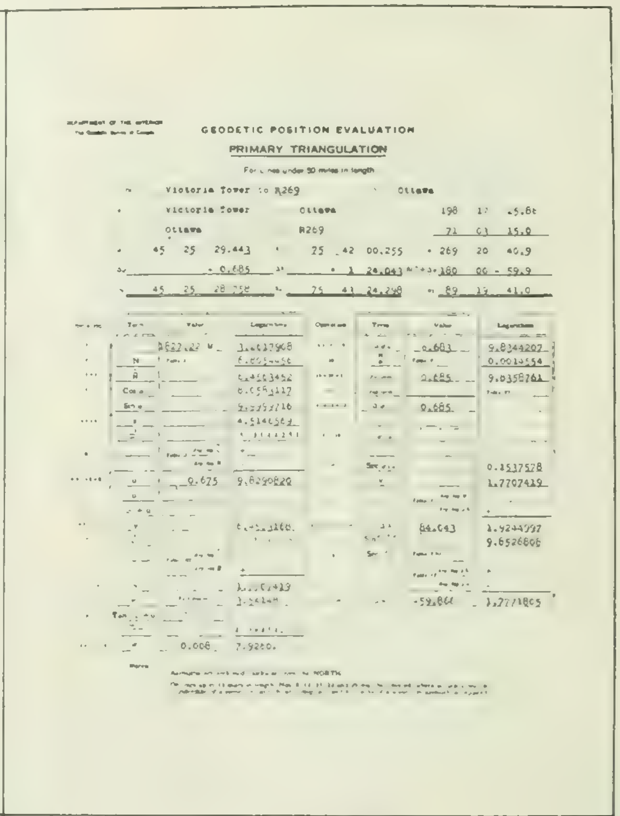
GEODETIC POSITION EVALUATION
Table 5. Log.N/R.

V		Log.N/R.	Diff.
42	00	0.0016 314 3	854
	10	228 9	854
	20	143 5	854
	30	0.0016 058 1	854
	40	0.0015 972 7	856
	50	887 1	855
43	00	801 6	856
	10	716 0	856
	20	630 4	857
	30	544 7	856
	40	459 1	858
	50	373 3	857
44	00	287 6	857
	10	201 9	857
	20	116 2	859
	30	0.0015 030 3	858
	40	0.0014 944 5	858
	50	858 7	858
45	00	772 9	858
	10	687 1	858
	20	601 3	858
	30	515 5	857
	40	429 8	858
	50	344 0	858
46	00	258 2	857
	10	172 5	858
	20	086 7	856
	30	0.0014 001 1	858
	40	0.0013 915 3	855
	50	829 8	857
47	00	744 1	856
	10	658 5	855
	20	573 0	856
	30	487 4	855
	40	401 9	854
	50	116 5	853
48	00	231 2	854
	10	145 8	853
	20	0.0013 060 5	852
	30	0.0012 975 3	851
	40	890 2	852
	50	805 0	851
49	00	719 9	849
	10	635 0	847
	20	550 1	848
	30	465 3	847
	40	380 6	847
	50	295 7	846
50	00	211 3	846
	10	126 7	844
	20	0.0012 042 3	843
	30	0.0011 958 0	842
	40	873 8	841
	50	789 7	841
51	00	0.0011 705 6	

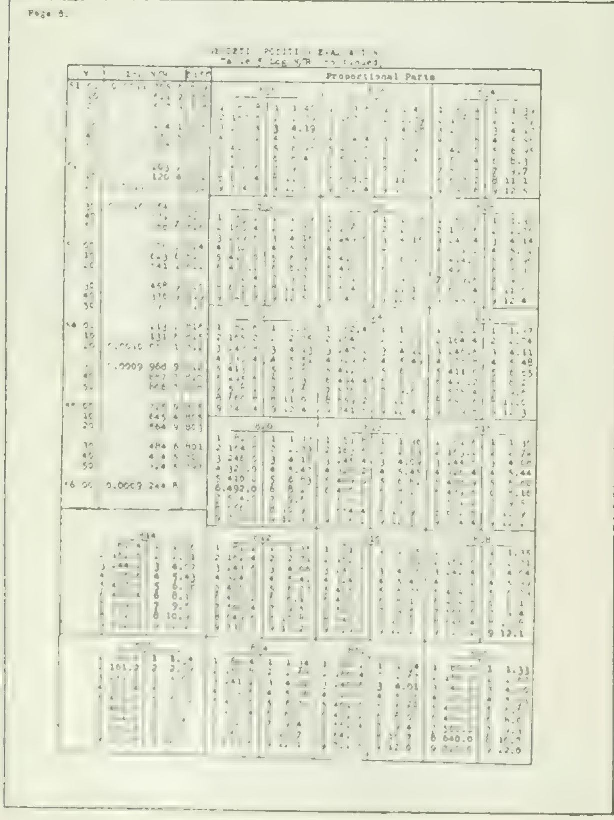
Proportional Parts

	855		856		854		852		850		848		846		844		842		840	
1	85.5	1.43	85.6	1.43	85.4	1.42	85.3	1.42	85.0	1.42	84.8	1.41	84.6	1.41	84.4	1.41	84.2	1.40	84.0	1.40
2	171.0	2.86	171.2	2.85	170.8	2.85	170.4	2.84	170.0	2.83	169.6	2.83	169.2	2.82	168.8	2.81	168.4	2.81	168.0	2.80
3	256.5	4.29	256.8	4.28	256.2	4.27	255.6	4.26	255.0	4.25	254.4	4.24	253.8	4.23	253.2	4.22	252.6	4.21	252.0	4.20
4	342.0	5.72	342.4	5.71	341.6	5.69	340.8	5.68	340.0	5.67	339.2	5.65	338.4	5.64	337.6	5.63	336.8	5.61	336.0	5.60
5	427.5	7.15	428.0	7.13	427.0	7.13	426.0	7.10	425.0	7.08	424.0	7.07	423.0	7.05	422.0	7.03	421.0	7.02	420.0	7.00
6	[illegible]	8.6	513.6	8.6	512.4	8.5	511.2	8.5	510.0	8.5	508.8	8.5	507.6	8.5	506.4	8.4	505.2	8.4	504.0	8.4
7	[illegible]	10.0	599.2	10.0	597.8	10.0	596.4	9.9	595.0	9.9	593.6	9.9	592.2	9.9	590.8	9.8	589.4	9.8	588.0	9.8
8	684.0	11.4	684.8	11.4	683.2	11.4	681.6	11.2	680.0	11.3	678.4	11.3	676.8	11.3	675.2	11.3	673.6	11.2	672.0	11.2
9	[illegible]	12.9	770.4	12.8	768.6	12.8	766.8	12.8	765.0	12.7	763.2	12.7	761.4	12.7	759.6	12.7	757.8	12.6	756.0	12.6

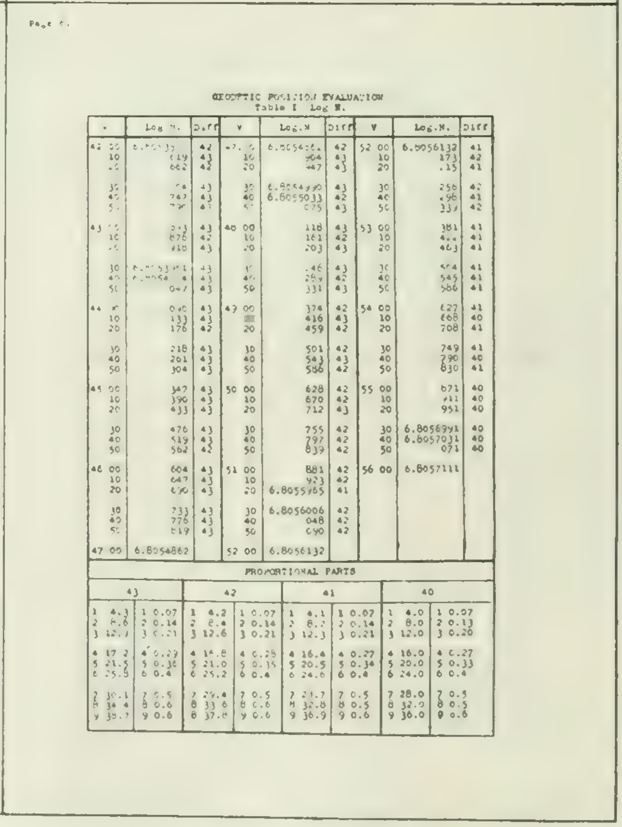




Page 5.



Page 6.



GEODETIC POSITION EVALUATION
Table I Log N.

″	Log N.	Diff	″	Log.N	Diff	″	Log.N.	Diff
42 00	6.80[illegible]	42	47 00	6.8054[illegible]	42	52 00	6.8056132	41
10	[illegible]19	43	10	[illegible]04	43	10	173	42
20	662	42	20	[illegible]47	43	20	[illegible]15	41
30	[illegible]	43	30	6.8054[illegible]	43	30	256	42
40	747	43	40	6.8055033	42	40	[illegible]96	41
50	[illegible]	43	50	075	43	50	337	42
43 00	[illegible]	43	48 00	118	43	53 00	381	41
10	876	42	10	161	42	10	[illegible]	41
20	[illegible]18	43	20	203	43	20	463	41
30	6.80[illegible]	43	30	[illegible]46	43	30	[illegible]4	41
40	6.8054[illegible]	43	40	289	42	40	545	41
50	047	43	50	331	43	50	586	41
44 00	090	43	49 00	374	42	54 00	627	41
10	133	43	10	416	43	10	668	40
20	176	42	20	459	42	20	708	41
30	218	43	30	501	42	30	749	41
40	261	43	40	543	43	40	790	40
50	304	43	50	586	42	50	830	41
45 00	347	43	50 00	628	42	55 00	871	40
10	390	43	10	670	42	10	911	40
20	433	43	20	712	43	20	951	40
30	476	43	30	755	42	30	6.8056991	40
40	519	43	40	797	42	40	6.8057031	40
50	562	42	50	839	42	50	071	40
46 00	604	43	51 00	881	42	56 00	6.8057111	
10	647	43	10	923	42			
20	690	43	20	6.8055965	41			
30	733	43	30	6.8056006	42			
40	776	43	40	048	42			
50	819	43	50	090	42			
47 00	6.8054862		52 00	6.8056132				

PROPORTIONAL PARTS

43		42		41		40	
1 4.3	1 0.07	1 4.2	1 0.07	1 4.1	1 0.07	1 4.0	1 0.07
2 8.6	2 0.14	2 8.4	2 0.14	2 8.2	2 0.14	2 8.0	2 0.13
3 12.9	3 0.21	3 12.6	3 0.21	3 12.3	3 0.21	3 12.0	3 0.20
4 17.2	4 0.29	4 16.8	4 0.28	4 16.4	4 0.27	4 16.0	4 0.27
5 21.5	5 0.36	5 21.0	5 0.35	5 20.5	5 0.34	5 20.0	5 0.33
6 25.8	6 0.4	6 25.2	6 0.4	6 24.6	6 0.4	6 24.0	6 0.4
7 30.1	7 0.5	7 29.4	7 0.5	7 28.7	7 0.5	7 28.0	7 0.5
8 34.4	8 0.6	8 33.6	8 0.6	8 32.8	8 0.5	8 32.0	8 0.5
9 38.7	9 0.6	9 37.8	9 0.6	9 36.9	9 0.6	9 36.0	9 0.6

Corporation of Professional Engineers of Quebec.

The annual general meeting of the Corporation of Professional Engineers of Quebec was held on the 29th March, 1922, at Montreal. A large number of engineers from all parts of the Province of Quebec were present. The meeting was presided by A. R. Decary, M.E.I.C., of Quebec, president of the Corporation.

In his annual report for the year 1921, Frederick B. Brown, the secretary of the Corporation, mentioned that the Law governing the practice of the profession of engineering in the Province of Quebec had been amended by the Legislature of Quebec in such a way as to provide for a more efficient control of the practice of the profession.

The Law now provides for the admission into the Corporation, of all graduates holding a diploma from the Ecole Polytechnique of Montreal and the Faculty of Applied Science of McGill University. The Law also provides that the Council may, at its discretion, upon a report made by the board of examiners of the Corporation to the effect that the candidate possesses the required knowledge, capacity and qualifications, admit as a member of the Corporation any person residing in the province and

A. R. DECARY, M.E.I.C.
President of Corporation of Professional Engineers of Quebec.

holding a diploma of civil engineering or the degree of Bachelor of Applied Science from any recognized school or university, or any member of other engineering societies or corporations of professional engineers of like importance, upon presentation of his credentials, and provided he pays the requisite fee for admission to practice. The Council shall also have the power to grant to any engineer, residing out of the Province of Quebec and being the holder of a diploma of civil engineering or of the degree of Bachelor of Applied Science from any school or university, recognized by the Council, or a member of other engineering societies or corporations of engineers likewise recognized by the Council, a temporary licence to practice, upon payment of the fees provided for by the By-Laws, on condition that the actual engineering work planned be carried out in collaboration with an engineer, member in good standing of the Corporation, provided these corporations or societies exact equivalent qualifications for the admission of its members, and that it grants the same privilege to members of the Corporation of Professional Engineers of Quebec.

No person can practise the profession of engineering in the Province of Quebec, unless he is a member in good standing of the Corporation of Professional Engineers of Quebec.

The total number of members up to the 31st December, 1921, was 505. It is now over 700, and it will most probably reach over 1200 within a few months.

The election of the officers and members of Council has resulted as follows:—

President, A. R. Decary; Vice-President, K. B. Thornton; Secretary-Treasurer, Frederick B. Brown.

Members of Council: A. B. Normandin, J. E. Gibeault, J. M. Robertson, Lt.-Col. C. N. Monsarrat and A. Surveyer. Registrar, A. Mailhiot.

LAW GOVERNING THE CORPORATION OF PROFESSIONAL ENGINEERS OF QUEBEC, AND THE PRACTICE OF THE ENGINEERING PROFESSION.

5116 The following expressions in this section have the meanings hereby assigned to them, unless the context otherwise requires:

a. The expression "the Corporation" means the corporation of professional Engineers of Quebec.

b. The expression; "the Council", means the Council of the said corporation;

c. The expression: "member," means a member of the said corporation;

d. The expression "civil engineer," means any one who acts or practises as an engineer in advising on, in making measurements for, or in laying out, designing or supervising the construction of railways, metallic bridges, wooden bridges the cost of which exceeds six hundred dollars, public highways requiring engineering knowledge and experience, roads, canals, harbors, river improvements, light-houses, and hydraulic, municipal, electrical, mechanical, or other engineering works, not including government colonization roads or ordinary roads in rural municipalities; but does not apply to a mere skilled artisan or workman. 61 V., c. 32, s. 1.

5116a. The present members of The Engineering Institute of Canada formerly "The Canadian Society of Civil Engineers," domciled and practising in the Province of Quebec, and all other personi whom they may in the future, join to them according to the provisions of this section, shall form a corporation under the name of "The Corporation of Professional Engineers of Quebec" with all the rights and privileges granted by law to ordinary corporations.

5116b. 1. Its affairs shall be administered by a council composed of eight members elected in the manner provided by the by-laws of the corporation.

2. It shall have the right to adopt by-laws for the proper administration of its affairs; to fix the annual contribution of its members; for the election of the members of the Council; for the guidance, the honour and the dignity of its members; for the admission to study and practice of the profession, in conformity with the provisions of articles 5119, 5120 and 5121; for establishing fees for professional services; for the admission to practice of persons who are members of any corporation or society of professional engineers of the other Provinces of Canada, provided such corporation or society enacts equivalent qualifications for the admission of its members and that it grants the same privileges to members of the corporation of this Province; for its affiliation to The Engineering Institute of Canada, and for all other objects necessary for the proper working of the corporation.

The tariffs of fees hereinabove mentioned shall not come into force until approved by the Lieutenant-Governor in Council and dublished in the Quebec Official Gazette.

5116c. The seat of the Corporation shall be in Montreal.

5116d. The members of the Executive Committee of the Provincial Division of Quebec of The Engineering Institute of Canada, shall form the provisional council of the corporation; they shall, before the first day of June 1920, by a notice signed by the secretary, and addressed, by registered letter, fifteen days in advance, to each of the members, call the first general meeting of the corporation for the purposes of adopting the by-laws thereof, and also to provide for the regular election of the council of the corporation.

5117. No person shall be entitled within the Province, to use the title of civil engineer, or any abbreviation thereof, or any name, title or description implying that he is a corporate member of the said corporation, or to act or practice as civil engineer within the meaning of article 5116, unless he is a corporate member of the Corporation or becomes such under the provisions of this section.

5118. The following are members of the Corporation:

(a) All persons, being practising civil engineers within the Province on the fifteenth day of January 1898 who, within one year therefrom, applied for admission to and paid the subscription fees required under the by-laws of the Corporation;

(b) All persons who, having been admitted to study under the provisions of this section, shall have passed the prescribed examination and shall have been licensed as civil engineers by the Corporation;

(ba) All persons having the right to use the title of Civil Engineer under an act of the Province of Quebec.

(c) All persons, being members of the Corporation of Land Surveyors of this Province, on the fifteenth day of January 1898, who apply for admission to the corporation and pay the subscription fees required under its by-laws;

(ca) The Engineers who, on the 31st of December, 1917, were active members of any recognized society of Civil Engineers and who resided and exercised their profession in the Province of Quebec during the four years preceding such date, provided that they have their names and addresses entered in the registers of the corporation before the 1st of March, 1921.

(d) Whosoever shall establish to the satisfaction of the Council that he was not a resident of this Province, on the fifteenth day of January 1898; that by reason of such absence he could not comply with the provisions of the law or give the periods of study and service required in the office or service of a corporate member of the corporation; that he has, however, been practising as a civil engineer, within the meaning of this section, for not less than ten years, and that he is a member of the highest grade of the Institute of Civil Engineers or of any other national engineering society of similar standing; and gives one month's notice, and, at the same time, pays the corporation the sum of fifty dollars, and passes the examination prescribed in paragraph (e) of article 6. 61 V., c. 32, s. 3; 2 Ed. VII, c. 25, s. 1.

5118a. The Council shall admit as a member of the corporation any person domiciled in the Province, who holds a diploma of civil engineering or the degree of Bachelor of Applied Science from the Polytechnic School of Montreal or the Faculty of Applied Science of McGill University, obtained after the 1st of March, 1922, provided that such person has been registered as a student member of the corporation during four years. The four years of clerkship required will not apply to students who are registered in the above-mentioned school and university on the 1st of March, 1922.

5118b. The Council may, in its discretion, upon a report made by the examiners of the corporation to the effect that the candidate possesses the required knowledge, capacity and qualifications, admit as a member of the corporation any person residing in the Province and holding a diploma of civil engineering or the degree of Bachelor of Applied Science from any recognized school or university, or any member of other engineering societies or corporations of professional engineers of like importance, upon presentation of his credentials, and provided he pay the requisite fee for admission to practice.

5118c. The Council shall have the power to grant to any engineer, residing out of the Province of Quebec and being the holder of a diploma of civil engineering or of the degree of Bachelor of Applied Science from any school or university, recognized by the Council, or a member of other engineering societies or corporations of engineers likewise recognized by the Council, a temporary license to practise, upon payment of the fees provided for by the by-laws, on condition that the actual engineering work planned by carried out in collaboration with an engineer, member in good standing of the corporation.

5119. There shall be a board of examiners, of not less than six persons, who shall be resident in the Province, to examine candidates for admission to the study, or for admission to the practice of civil engineering.

Four members of this board, two of whom must have the proper qualifications and competency to examine all candidates for preliminary and final examinations in French or in English, at the option of the candidate, shall be appointed by the council, one member by McGill University, and one by the Polytechnic School.

The board shall meet at least twice each year, at the cities of Quebec and Montreal, alternately, on the first Tuesday in May and November. 61 V., c. 32, s. 4.

5120. 1. A candidate for admission to study shall:

(a) Give one month's notice to the secretary of the corporation of his intention to present himself for examination, and at the same time shall pay such secretary the sum of twenty dollars as fee, one-half of which shall be remitted in the event of failure to pass the prescribed examination;

(b) Produce a certificate of good character;

(c) Pass an examination in the following subjects, viz. grammar and composition, in either English or French, geography, that of Canada in particular, history of Canada, arithmetic, elements of geometry, use of logarithms, algebra up to and including quadratic equations, trigonometry up to and including the solution of plane triangles.

2. If successful, the candidate shall be entitled to a certificate that he has passed such examination.

3. If, on the fifteenth day of January 1898 the candidate holds a certificate of having been admitted to study as a provincial land surveyor, then such certificate shall be accepted in place of the foregoing examination.

2a. The junior members of the Engineering Institute of Canada, domiciled in the Province on the 1st of April 1922, may, in the discretion of the Council, be admitted as members of the Corporation after having taken the examination for admission to practice, providing they have their names and addresses entered in the registers of the Corporation before the 1st of March, 1923.

3. All examinations shall be conducted in French or English at the option of the candidate. 61 V., c 32, s. 6.

5122. Any student who has passed the examination prescribed by this section shall be entitled to receive a diploma and shall become a corporate member of the corporation. 61 V., c. 32, s. 7.

4. If the candidate holds a degree of Bachelor of Applied Science, Bachelor of Arts, Bachelor of Sciences, or Bachelor of Letters, conferred upon him by a university recognized by the Council, or has graduated from and holds the diploma of the Royal Military College, or proves, to the satisfaction of the Council, that he has passed the examinations for admission to study in an engineering school or university, recognized by the Council, or holds a diploma as provincial land surveyor in this Province, he shall, on making satisfactory proof that he is the person named in such degree or diploma, be entitled, on payment of the above mentioned fee, to receive a certificate permitting him to study.

5. The student members of the Engineering Institute of Canada, domiciled in the Province on the 1st of March 1922, shall be entitled to a certificate of admission to study, counting from the date of their admission in the Engineering Institute of Canada, providing they make application therefor before the 1st of March 1923.

6. Every student must perform the clerkship exacted by the provisions of this section, under indentures entered into with an engineer member of the corporation, which indentures shall be passed before a notary, as well as any transfer that may be made thereof, and an authentic copy of same must be deposited with the registrar. The period of clerkship shall count only from the date of registration with the registrar of the corporation.

5121. 1. A candidate for admission to practice shall:

(a) Give one month's notice of his intention to present himself for examination and at the same time, pay the secretary the sum of forty dollars, as a fee:

(b) Produce a certificate of good character;

(c) Establish that he is at least twenty-one years of age;

(d) Establish that, since his admission to study, he has been engaged in the pursuit of civil engineering in the office or in the service of a corporate member of the society for a period of at least five years, or for a period of two years if he holds a diploma as a provincial land surveyor.

(e) Pass an examination before the board of examiners of the society on the theory and practice of civil engineering, and especially in one of the following branches at his option: railway, municipal, hydraulic, mechanical, mining or electrical engineering.

2. Indentured pupils of civil engineers, on the fifteenth day of January 1898 who, within six months thereafter, registered their indentures with the corporation and paid the admission fees, shall, upon the completion of the full term of five years, be admitted to practice on passing the preliminary and final examinations as herein prescribed.

5123. No by-laws, passed or that may be passed , by the corporation, shall have force or effect in this Province until approved by the Lieutenant-Governor in Council. 61 V., c. 32, s. 8.

5124. No person practising the profession of civil engineer, and not entitled to do so under this section, shall recover before any court of justice any sum of money for the professional services rendered in such capacity. 61 V., c. 32, s. 9.

5125. Any person, not being a member in good standing of the Corporation of Professional Engineers of Quebec, who:

(a) Practises the profession of civil engineer; or

(b) Usurps the functions of the profession; or

(c) Assumes verbally or otherwise the title of civil engineer or makes use of any abbreviation of such title, or of any name, title or designation which might lead to the belief that he is a civil engineer or a member of the corporation; or

(d) Advertises himself as such in any way or by any means; or

(e) Acts in such manner as to lead to the belief that he is authorized to fulfill the office of or to act as a civil engineer,—shall be liable, on summary conviction, to a fine of not less than one hundred dollars nor more than two hundred dollars, and, on failure to pay the same, to imprisonment for not more than three months, for the first offence, and for any subsequent offence, to a fine of not less than two hundred dollars nor more than five hundred dollars , and, on failure to pay the same, to imprisonment for not more than six months.

5126. Nothing in this section shall be deemed to encroach upon the rights and privileges conferred upon provincial land surveyors by any act of the Legislature. 61 V., c. 32, s. 11.

Canadian Engineering Standards Association

Progress of Work, First Quarter 1922.

Under Revision

Steel Railway Bridges

Decision made to Undertake Standardization

Road Materials
Canadian Electrical Code
Gasoline for Automotive Work
Commercial Bar Steel

Work in Hands of Technical Committees

Concrete and Reinforced Concrete
Steel Reinforcing Bars
Wire Strand
Screw Threads
Gearing
Station Type Transformers
Rating and Testing Rules for Electrical Machinery
Steel Tubing for Aircraft
Flexible Steel Wire Rope for Aircraft
Steel Sheets for Aircraft
Rails
Material for Steel Forgings
Mining Drill Chucks and Steel

Draft Specification or Report Under Consideration

Steel Highway Bridges
Watthour Meters
Incandescent Lamps
Wood Poles for Transmission Lines

Standard Approved for Issue

Steel Railway Bridges
Portland Cement
Wire Rope
Galvanized Telegraph and Telephone Wire
Distribution Type Transformers

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Preliminary Notice

of Applications for Admission and for Transfer

20th April, 1922

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer rom one grade of membership to a higher.

It is also provided that there shall be issued to all corporate member a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in May, 1922.

FRASER S. KEITH, Secretary.

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*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the fo lowing branches at his option, Railway, Municipal, Hydraulic, Mechanical, Mining or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidat. has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years oe age, and must have been engaged in some branch of engineering for at least four yearsf This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects, Geography, History (that of Canada in particular), Arithmetic, Geometry Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits cientific acquirements, or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

> The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BARLOW—ARTHUR, of New Aberdeen, N.S. Born at Denaby, England, May 5th, 1891; Educ., D.S.C.R. course in surveying, 1920. Military aeronautic school courses, 1918; N.S. Technical mining school, Oct. 1920 to date. Granted overman's certificat. 1921; 1908-10, rodman, N.T.C. Rly.; 1911-12, rodman in mines, Denaby Collieries England; 1915-16, attached field survey co'y. Royal Engrs. as levelman. Commissioned, R.A.F., 1919; Nov. 1920 to date, employed in mining engr's dept., Dominion Coal Co., Glace Bay, N.S.

References: A. L. Hay, D. Morrison, J. R. Morrison, S. C. Mifflen, H.C Chipman.

BISHOP—WILLIS D., of 25 Westminster Avenue South, Montreal West, Que. Born at Poughkeepsie, N.Y., U.S.A. in 1884; Educ., elec. engr., I.C.S.; 1902 (8 mos) shop work, De Laval Separator Co., Poughkeepsie, N.Y.; 1903 (10 mos), experimental dfting. and shop work, Adriance Platt & Co., Poughkeepsie, N.Y.; 1904-05, dftsman., General Electric Co,. Schenectady, N.Y.; 1905-11, with General Electric Co., Schenectady, N.Y., as designing engr. on switchboards and switching equipments. 1911-13, work on design of types K-10, K-12, H-3 and H-6 oil circuit breakers, relays, etc., with same compapy; 1913-17, with Canadian General Electric Co. Ltd. on similar work, including estimating; July 1917 to date, with Northern Electric Co. Ltd. as designing and estimating engr. on power switchboards and switching apparatus and layouts. Since May 1921 in charge of sales effort also.

References: P. F. Sise, W. C. Adams, K. B. Thornton, A. R. Henry, N. C. Mills, D. M. Fraser, A. B. Cooper, G. P. Cole.

BLADON—JAMES BUCKLEY, of 35 Holton Avenue, Westmount, Que. Born at Patchway, Gloucester, England; July 4th, 1875; Educ., Univ. College of North Wales, Bangor. Intermediate B.Sc. course, London Univ., 1891-93. Edinburgh School of Technology, Heriot Watt College, Advanced engr'g. course, 1894-97. Evening classes, Newcastle-on-Tyne, extension lectures, elect'l. engr'g., 1900-02; 1893-95, ap'ticeship, London & South Western Railway Co., Southampton, and 1895-99, ap'ticeship S. &. H. Morton & Co., Engineers (Marine), pattern shop, fitting shop and dfting.; 1899-1900. engr. dftsman., Cochrane & Co., Annan, Scotland, Marine Engrs.; Feb. 1900 to Jan. 1902, with Sir W.G. Armstrong Whitworth & Co. Ltd., Walker Ship Yard, Newcastle-on-Tyne, special work on design of oil-burning equipment for torpedo-boat-destroyers and oil tank merchant ships; 1902 (Jan.-May), with R. &. W. Hawthorn Leslie & Co., Ltd., oil fuel equipment war vessels; 1902 to date, with Darling Brothers Limited, Engrs. and Mfrs., Montreal as follows:—1902-08, chief dfstman., 1908 to date chief engineer, and responsible for heating and ventilation of many large bldgs. throughout the Dominion.

References: J. A. Jamieson, J. T. Farmer, J. S. Costigan, J. H. Hunter, S. F. Rutherford, J. D. Alder.

BONE—ALLAN TURNER, of 43 St. Mark Street, Montreal, Que. Born at Glasgow, Scotland, Feb. 2nd, 1895; Educ., B.Sc. McGill Univ., 1916; 1916 (4 mos.), dftsman., Halifax Ocean Terminals, under J. J. MacDonald, then transferred to docks dept., under A. C. Brown, as dftsman., designer, inspr., instr'man. and ass. engr. until 1919 (This period includes 3 mos. dfting and designing with Ross & MacDonald); 1919 (Apr.-Dec.), engr. for G. A. Fuller Co. Ltd. as mgr. on T. Eaton mail order bldg., Moncton, N.B.; 1919-21, transferred to Temiskaming on constrn. of Kipawa Mills for Riordon Co. Ltd.; 1921, engr. for G. A. Fuller Co. on Canada Cement Co. Bldg., Montreal.

References: H. M. MacKay, A. C. Brown, A. F. Byers, R. E. Jamieson, F. B. Brown, P. T. Bone.

BONNELL—MOSSOM BURWELL, of Ottawa, Ont. Born at Bobcaygeon, Ont., Sept. 16th, 1880; Educ., B.A.Sc. Univ. of Toronto, 1905; 1905-07, ap'ticeship with diploma, Westinghouse Elec. and Mfg. Co., Pittsburg; 1902, ap'ticeship, machine shops, Can. Gen. Elec. Co., Peterborough, Ont.; 1905, asst. engr., Riordon Pulp & Paper Co., Merriton, Ont.; 1908-09, dftsman., Dept. Interior, Ottawa; 1909 to date, examiner in charge of division of electrical apparatus, Canadian Patent Office, Ottawa, Ont.

References: R. C. Berry, F. D. Withrow, A. E. MacRae, R. L. Haycock, J. E. N. Cauchon, D. H. Nelles.

BOULTON—WILLIAM JAMES, of Ottawa, Ont. Born at Wallaceburg, Ont., Oct. 2nd, 1883; Educ., B.A.Sc. Univ. of Toronto, 1912; D.L.S.; 1905-06, transitman, Georgian Bay Ship Canal; 1908 (May-Oct.), engr. in charge of party — survey of 15 mile creek route, Welland Ship Canal; 1910 (Feb.-July), res. engr., Ontario Power Co., constrn. of conduits and power house; 1910-11, engr. in charge of party — survey of Ten Mile Creek and Jordan routes, Welland Ship Canal; 1912-13, asst. to D.L.S.; 1913-21, chief of party on Dom. Land Surveys, under instructions from the Topog'l. Surveys Branch, and at present chief of party, general surveys, Topog'l. Surveys Branch, Dept. of the Interior, Ottawa, Ont.

References: S. J. Chapleau, F. V. Seibert, G. H. Herriot, W. H. Sullivan, J. L. Rannie, E. S. Martindale, G. C. Cowper, P. E. Palmer, P. Gillespie, R. C. Purser, J. A. Stiles, D. H. Nelles.

BRENOT—LUCIEN EDWARD HONORE, of Ottawa, Ont. Born at Aylmer, Que., Aug. 31st, 1888; Educ., Ottawa Collegiate, 4 year private tuition. D.L.S. 1910; 1911 to date, chief in charge of various surveying parties, and at present chief in charge of a party on topog'l. and land classification surveys.

References: F. V. Seibert, G. H. Blanchet, N. S. Clouston, G. C. Cowper, P. E. Palmer, S. D. Fawcett, A. L. Cumming, E. M. Dennis, E. S. Martindale, C. H. Taggart, C. Rinfret, R. C. Purser, G. H. Herriot.

CARTMEL—WILLIAM BELL, of 561-A Lasalle Road, Verdun, Que. Born at Liverpool, England, Jan. 4th, 1872; Educ., B.S., Case School of Practical Science, Cleveland, Ohio, 1900. M. A. Univ. of Nebraska, 1902. Whiting Fellowship in Physics, Harvard Univ. 1905-07.; laboratory asst. Bureau of Standards, Washington, 1902-03; 1903-05, instructor in physics, Univ. of Cincinnati; 1907-11, professor of physics and elect'l. engr.'g., Univ. of N.B.; 1911 to date, engr'g. dept., Northern Electric Company Limited, Montreal. From 1915, transmission engr., in charge of transmission division.

References: W. C. Adams, J. D. Hathaway, J. S. Cameron, E. A. Stone, H. W. Fairlie, W. H. Eastlake.

CASEY—WILLIAM, of Kingston, Ont. Born at Kingston, Oct. 13th, 1887; Educ., junior matric., Regiopolis College, 1901; 1901 to date, with the Canadian Locomotive Company, as follows:—1901-02, office boy, 1902-06, machinist ap'tice., 1906-07, dftsman. on locomotives, 1907 (Jan.-Mar.), shop engr. dftsman., 1907 (Mar.-Sept.), foreman tender shop, 1907-1911, foreman machine shop, 1911-13, piece work supervisor and production engr., 1913-14, estimating engr., 1914-16, asst. to vice-president and gen. mgr., 1916-17, mgr., 1917-20, gen. mgr. Elected to Board of Directors, Sept. 1920. Vice-president and gen. mgr. to date.

References: J. M. Campbell, H. H. Vaughan, L. M. Arkley, L. T. Rutledge, R. Hobson.

CLARKE—JOHN LEONARD, of 124-44th Avenue, Lachine, Que. Born at Birmingham, England, Oct. 31st, 1887; B.Sc. London University, 1909; 1912-16, design of layout of telephone plant (outside constrn.) in various towns and cities; with Bell Telephone Co. of Canada since 1910, and since 1916 on telephone engr'g. work having charge of all special investigations and issuance of specifications controlling cases of inductive interference, crosstalk, electrolysis, etc.

References: G. M. Hudson, A. M. Mackenzie. J. H. Trimingham, A. B. Manson, J. E. Openshaw, A. Lariviere.

DAVIS—WILLIAM BOYD, of Lakefield, Ont. Born at Ivy, Ont., Aug. 9th, 1889; Educ., B.A.Sc. Univ. of Toronto, 1912, 1910 (summer), rodman, Dom. Govt. Irrig. work in Alberta and Sask.; 1912-14, leveller, and 1914 to date, asst. engr., Trent Canal. At present in charge of constrn. at Lakefield Dam.

References: G. Kydd, L. Sherwood, A. J. Grant, A. P. Miller, R. L. Dobbin, R. B. Rogers.

FORDE—ELROY, Lieut.-Col., D.S.O., of Ottawa, Ont. Born at Dundas, Ont., Sept. 10th, 1885; 3 years C.P.R. Telegraph Company; 3½ years, operation and mtce. dept., Dominion Power and Transmission Co., Hamilton, Ont.; 1909-14, district and command signal officer with headquarters military district No. 2, Toronto; 1914-15, brigade signal officer, 3rd infantry brigade, C.E.F.; 1915-17, commanded 1st Division (C.E.F.) Signal Company; 1917-19, chief signal officer, Canadian Corps; 1919 to date, asst. director of signals for Canada, Dept. of Militia and Defence, Ottawa, Ont.

References: A. G. L. McNaughton, Sir. Alex. Bertram, C. H. Mitchell, C. J. Armstrong, A. Macphail, J. Houliston, H. L. Sherwood, J. D. Chene, J. B. Cochrane, T. E. A. Hall.

FRASER—JOHN ALFRED, of Glace Bay, N.S. Born at North East Margaree, N.S., Oct. 2nd, 1883; Educ., I.C.S. Govt. Tech. Mining Class, 1908-12. Mechanical Drawing Class, 1909-11. Prov. Land Surveyor's Cert. 1916. Underground Manager's Cert. 1911; With Dominion Coal Company Limited as follows:— 1903-04, survey helper, 1904-12, compass mine surveyor, 1912-20, transit surveyor, and at present, ventilation engr., also chief inspector on airway constrn.

References: K. H. Marsh, A. L. Hay, H. C. Chipman, S. C. Mifflen, J. J. McDougall.

GATES—GRANT GORDON, of 198 Fairleigh Avenue South, Hamilton, Ont. Born at Fairground, Ont., July 18th, 1895; Educ., McGill Univ. 1916-17; 1916 (5 mos), rodman; 1918-20, asst. on city and suburban surveys, J. W. Tyrrell & Co.; 1921-22, in charge of party on topog'l. surveys and subdivisions, city and suburban surveys.

References: J. W. Tyrrell, J. E. Jackson, E. G. MacKay, F. W. Paulin, C. H. Marrs, F. D. Pringle.

GILLIS—HUGH BERNARD, of Sydney, N.S. Born at Sydney, N.S., May 16th, 1881; Educ., B. A. St. Francis Xavier Univ. 1901. B.Sc. McGill Univ. 1909; 1901-05 (summers), engr's office, Dom. Iron and Steel Co.; 1909-16, engr., mines and quarries dept., and from 1916 to date, supt. in charge of ore mines and quarries dept., Dominion Iron & Steel Co., Sydney, N.S.

References: C. M. Odell, K. H. Marsh, F. S. Keith, G. D. Macdougall, D. H. McDougall.

HARDOUIN—JOSEPH, of Ottawa, Ont. Born at Rennes, France, Ont. 17th, 1879; Educ., D.L.S.; 1902-03, in charge of a sugar factory in the island of La Reunion; 1911-12, in charge of survey work, with A. P. Patrick, D.T.A. of Calgary; 193, land subdivision work with W. J. Boulton, D.L.S.; 1914, townsite subdivision work with T. D. Green, D.L.S.; 1919, topog'l. survey work with W. J. Boulton; 1920, in charge of a survey party north of Prince Albert; 1921, in charge of a survey party in Southern Sask. and Man., topog'l. survey work; At present in charge of a survey party doing topog'l. survey work in Southern Alberta.

References: G. C. Cowper, P. E. Palner, R. C. Purser, F. V. Seibert, G. H. Herriot, E. S. Martindale.

HOBART—GEORGE MAXWELL of London, Ont. Born at Kingston, Ont., Nov. 11th, 1894; Educ., B.Sc., McGill Univ. 1920, 6 mos. course industrial chemistry, Glasgow Univ., 1919; 1913, dftsman., Dominion Bridge Co., Lachine; 1914, asst. engr., plant No. 1, Canada Cement Co.; 1917-19, overseas. Lieut. Siege Artillery; Jan. 1921 to date, industrial and chemical engr., Somerville Paper Boxes Limited, London, Ont.

References: H. B. R. Craig, J. Robertson, W. Johnston, D. C. Tennant.

LASH—NORWOOD MAXWELL, of Montreal, Que. Born at Toronto, Ont., Oct. 30th, 1871; Educ., Grad. S.P.S. Univ. of Toronto, 1894; 1891-92, Toronto Electric Light Co., 1895-1900, engr. and foreman installer of telephone central office installations; 1900-14, asst. chief engr., and from 1914 to date, chief engr., Bell Telephone Co. of Canada, Montreal.

References: W. J. Francis, W. C. Adams, J. D. Hathaway, J. M. R. Fairbairn, R. M. Wilson.

MAY—ALEX. HARVEY, of 275 Argyle Road, Walkerville, Ont. Born at Edinburgh, Scotland, May 7th, 1878; Educ., B.A.Sc. (E.E.), Charlottenburg Univ., 1899; 5 years ap'ticeship, British Thompson Houston Co., Rugby, England; Construction engr. of hydro-elec'l. install'n. up to 30,000 H.P., including elect'l., mech., civil and mining engr'g. in India for a period of 11 years in executive and designing engrs. capacity; 1 year in charge constrn. Keoku Hydro-elec. Scheme — also in charge of install'n. 5000 K.W. steam turbine and sub-station constrn.; 1 year, efficiency engr., Dodge Bros., Detroit; 1½ years, regimental master engr., senior grade, U.S. Army, France; 3 years, works engr., General Motors of Canada; At present, constlg. elect'l. mech. and general engr., Walkerville, Ont.

References: A. A. Bowman, J. B. C. Keith, G. F. Porter, O. M. Perry, H. C. McMordie.

McKENNA—JOHN ANDREW, of 383 O'Connor Street, Ottawa, Ont. Born at Brierly Brook, N.S., May 10th, 1873; Educ., B.Sc. (Mech. Eng.), Mass. Inst. of Technology, 1903. B.A. St. Francis Xavier Univ. 1904; 1903-05, professor of engr'g. mathematics. and drawing, St. Francis Xavier Univ.; 1905-11, patent examiner, Can. Patent Office; 1911 to date, engineer, Dept. Militia and Defence, since 1917 Controller of Military Lands, and at present senior asst. engr. and controller of military lands, Engineer Services, Major C.E., O.C. 3rd Field Company, Canadian Engineers.

References: J. Houliston, A. P. Deroche, F. H. Emra, J. B. Cochrane, J. B. Challies, R. de B. Corriveau, F. H. Kitto, R. S. Smart, J. B. McRae, C. P. Edwards, E. J. Walsh, H. E. M. Kensit.

MEDLAR—GEORGE ELMER, of 24½ Huron Street, Walkerville, Ont. Born at Saltfleet Township, Wentworth Co., Ont., Sept. 24th, 1892; 1908-09, junior, Tyrrell & McKay, Hamilton, Ont.; 1909-10, transitman, misc. surveys, W. H. Waddell, Edmonton District, D.L.S.; 1910-11, asst., district engr'g. and surveying work, Saskatoon District, E. K. Phillips; 1911-18, asst. in charge of parties, D. L. Surveys, townsite, city, subdivisions, land tie surveys, dfting. and office work, Prov. of Alberta; 1918 (Jan. -Dec.), R.F.C.; 1919 (Mar.-Aug.), asst., harbour development work, Hamilton; 1919-20, asst., sewer and waterworks constrn., power dam development Surveys, Northern Ontario; 1920 (Mar.-Aug.), asst., misc. surveying and engr'g. work, Hamilton District; At present, engr. in charge of field and office work for the Essex Border Utilities Commission, Windsor, Ont.

References: J. C. Keith, M. E. Brian, W. J. Fletcher, C. R. McColl, J. E. Hollaman, J. W. Tyrrell, R. W. Jones.

MELVILLE—JAMES LEARMONTH, Capt., M.C. and Bar, of Ottawa, Ont. Born at Glasgow, Scotland; Dec. 30th, 1888; Educ., Junior Engr'g. Science Cert. (3 years course), Glasgow & West of Scotland Technical College; 1904-08, ap'tice. with A. Gillespie & Sons, Consltg. Engrs., Glasgow; 1908-10, journeyman with above firm; 1910-13, senior dftsman. and in charge of special contracts for Glasgow Steel Roofing Co. Ltd.; 1913-15, with J. Coughlan & Sons, Vancouver, B.C. in charge of detailing squads on constrn. of C.P.R. Depot, B.C. Telephone Building, Marpole Wing Hotel, Vancouver, etc. Also with Canadian Northwest Steel Co., Vancouver, and H. Bittman, Seattle on similar work. Employed as asst. supt. of steel on $750,000. cold storage warehouse for Port of Seattle Commission, Aug. 1914 to March 1915; Oct. 1915 enlisted in Can. Engrs. During last year of war was field engr. in charge of all bridge constrn. for the Canadian Corps; At present, Unit Director of Administration for Eastern Ontario, D.S.C.R., Ottawa.

References: N. F. Parkinson, W. B. Lindsay, W. P. Wilgar, R. F. Armstrong, F. O. Hodgins, A. U. Meikle, E. P. Fetherstonhaugh.

NASH—THOMAS SANFORD, of 33 First Avenue, Ottawa, Ont. Born at Morrisburg, Ont., July 2nd, 1875; Educ., Grad. S.P.S. Univ. of Toronto, 1902. D.L.S.; 1902 (May-Dec.), asst. to D.L.S., in charge of a sub-party; 1902-04 and 1906-07, examining returns of survey of Dominion lands and preparing the official plans therefrom for use in granting title; 1904-06, in charge of a survey party engaged in the inspection of contract surveys in the western provinces; 1907 to date, in charge of a major division of the Topog'l. Surveys Branch of the Dept. of the Interior, comprising ... 25 to 40 technical officers.

References: J. B. Challies, G. H. Herriot, F. H. Kitto, E. B. Jost, J. L. R..., W. C. Way, E. S. Martindale, C. H. Taggart, E. M. Dennis, G. C. Cowper.

PATERSON—GRAHAM FERGUSON, of 50 Highfield Road, Toronto, Ont. Born at Paisley, Scotland, March 4th, 1890; Educ., Glasgow Royal Technical College, 1908; 1908-11, indentured ap'tice with Warren & Stuart, Civil Engrs., Glasgow, Scotland and 1909-10, res. engr. for same firm on Polmont & Rumford drainage and sewage disposal; 1911, Dunbar Water Works, in charge of field work, and preparation of parliamentary plans. Also with W. P. Weir, C.E., preparing plans, specifications, etc., for Irvine Shipbldg. Yard and Slip-dock; 1912-13; asst. on the staff of engr. to the joint railways committee of the Caledonian and Glasgow and South Western Railways. In charge of permanent way mtce., Glasgow and Kilmarnock section; 1913, sewer section, works dept., City of Toronto; 1914-19, overseas, Capt., Royal Engrs.; 1919-20, with Maxwell Motor Corpn. Detroit, Mich., inspecting and supervising work in the erection of new plant; 1920-21, asst. on the staff of A. H. Seers, chief engr., dept. of sewers, City of Detroit, Mich.; 1921 to date, designer, sewer section, works dept., City of Toronto.

References: G. Phelps, F. J. Hancox, W. R. Worthington, C. D. Roberts, J. C. Murton, H. J. Ross, I. H. Nevitt, H. S. Philips, D. Molitor, G. D. Mackie

REID—BRIAN LEE, of Peace River, Alta. Born at Sault Ste Marie, Ont., Dec. ..., 1893; Educ., Science matric., McGill Univ. 1912; 1911-13, Algoma Central Rly.; 1913-14, Lake Huron and Northern Onatrio Rly., Lake Superior Power Co., and Department Public Works; 1914 (Apr.-Aug.), in charge of parties making surveys, etc., for Lang & Ross, Surveyors, Sault Ste. Marie, Ont.; 1917-19, overseas. Can. Rly. Troops., Lieut., M.C.; 1919-21, res. engr., C.P.R.; 1921-22, res. engr. in charge of 13 miles of constrn., and from Jan. 1922 to date, res. engr. in charge of operation and constrn., Peace River Extension, Central Canada Rly.

References: W. A. James, J. G. Reid, C. L. Hervey, D. A. Livingston, S. R. Lamb, R. S. McCormick, C. H. Pozer, J. L. Lang.

RICKARDS—CHARLES SELBY, of Iroquois Falls, Ont. Born at Banff, Alta., Nov. 20th, 1896; Educ., Hamilton Technical School; 1912-13 (summers), mech. ap'tice (student), in the Ogden Shops, C.P.R. at Calgary, Alta.; 1915 (8 mos.), hydrographical survey, Dom. Govt.; 1916-19, elect'l. ap'tice, Canadian Westinghouse Co., Hamilton, Ont.; 1919-21, with Canadian Westinghouse Co., 1 year, trouble engr., 1 year asst district engr. in Calgary district, 6 mos. engr's. asst. on constrn., 1921 to date, ... engr., Abitibi Power & Paper Co. Also instructor of electrical classes in the technical school, Iroquois Falls, Ont.

References: F. H. Peters, J. S. Dennis, A. S. Dawson, K. C. Berney, L. E. ...ndall.

ROSS—JOSEPH HOPE, of Calgary, Alta. Born at Menstrie, Scotland, Ont. ..., 1887; Educ., private study. Master Electr'n. certificate, City of Calgary; ...-06, ap'tice with the following firms, Crescent Electric Co., Finlayson & Boyd, ... Electric Co.; 1906-07, journeyman with North West Electric Co., and Enterprise Electric Co.; 1908 (3 mos.), salesman, Jenkins Brass Mfg., Montreal; 1908 (3 mos) journeyman telephone, Enterprise Electric; 1908 (6 mos.), inspr., Western Electric, Seattle Wash.; 1909 (3 mos.), asst. power plant expert, M. L. Wright Co., Shelton, Wash.; 1909 (9 mos.), in charge of out of town work, Enterprise Electric Co., Calgary; 1910, winding and special work, City Electric, Edmonton; 1910-11, ...b foreman, Enterprise Electric Calgary, Alta; 1912-17, elect'l. inspr., City of Calgary ...17, instructor in elec. science; 1917-18, instructor in elect'l. science under D.S.C.R.; ... 4½ mos), elect'n. and magnet repair man, R.A.F., Toronto; 1919-20, member ... Fyles-Ross Engr'g. and Agency Co., Calgary; 19 9 (Jan.-Mar.), vice-principal, Mar. 1919 to Oct. 1920, principal, Institute of Technology and Art, Calgary (under D.S.C.R.); Oct. 1920 to date, acting principal, Provincial Institute of Technology and Art, Calgary.

References: W. A. Davidson, F. K. Beach, R. S. Trowsdale, C. C. Richards, L. F. Fyles.

WATT—GEORGE HERBERT, of Torrington Place, Ottawa, Ont. Born at Ingersoll, Ont., Feb. 5th, 1876; Educ., Grad. in mining, S.P.S., Univ. of Toronto, 1899; 1899, assayer at the Empress Mine, Jackfish; 1899 accepted position in the Topog'l. Surveys Branch on examination of suryey returns for record. 1902, comm'd. as D.L.S. ..., engaged in office on misc. work on preparation of descriptions of land for deeds ... 1904, appointed inspr. of surveys for Alberta. 1905-06, in charge of first division ... office of Surveyor General. Resigned in 1906 to take up private practice and continued until 1911, when reappointed to Topog'l. Surveys Branch, as assit. chief of section special surveys division. At present asst. office engr. in division of surveys information.

References: G. H. Herriot, J. D. Craig, F. V. Seibert, W. M. Tobey, W. H. ...rish.

WHILLANS—THOMAS OLIVER, of Hurdman's Bridge, Ont. Born at Hurdman's Bridge, Ont., Nov. 22nd, 1890; Educ., B.Sc. Queen's Univ. 1917; 1915-16 (summers), machine shop, Canadian Locomotive Co., Kingston, Ont.; 1917-18, asst. testing engr., Imperial Ministry of Munitions, Welland, Ont.; 1919-20, mech. engr., Pedlar People Ltd.; Oshawa, Ont.; April 1921 to date, asst. patent examiner, Canadian Patent Office, Ottawa, Ont.

References: A. E. MacRae, R. C. Berry, C. S. Boyd, F. G. Bird, J. F. D. Withrow, W. H. Slinn.

WILSON—JAMES ALEXANDER, of 425 Sunnyside Avenue, Ottawa, Ont. Born at Montreal, Que., Jan. 10th, 1887; Educ., I.C.S. courses. civil engr., mech. dfting. arch'ture and concrete engr.'g.; 7½ years, machinist; 2 years dftsman., Jeffrey Mfg. Co.; 2 years dfting., Ottawa Car Co., 1½ years, dfting., British American Nickle Corp.; 1913-18, supt., car dept., Ottawa Car Co.; 1 year ending March 1921, asst. supt., copper dept., British American Nickle Refinery; Also about 3 mos. in charge of furnace constrn. and install'n., for above company; 1 season (1921), asst. engr. on concrete construction work, Ottawa Suburban Roads Commission; At present designing a special drying plant for John Lumsden, Lumber Manufacturer, Ottawa, Ont.

References: G. G. Gale, A. K. Hay, W. H. G. Flay, J. A. S. King, R. L. Peck, G. E. Booker, C. D. Norton.

WILSON—WILLIAM GILLESPIE, of 60 Whitney Avenue, Sydney, N.S. Born at Motherwell, Scotland, June 16th, 1884; 1913-17, supt. in charge of slabbing mill, universal and sheared plate mills, Carnegie Steel Co., Homestead, Pa.; 1917-18, charge at Liberty Mill (110" plate mill), same works; 1918-21, supt. of 110" plate mill, Dominion Iron & Steel Co., and from Dec. 1921, asst. gen. supt. in charge of mills operations, same company.

References: J. H. Fraser, H. Longley, K. H. Marsh, A. P. Theuerkauf, G. D. Macdougall.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

BLACK—MAURICE W., of Fredericton, N.B. Born at Windsor, N.S., Feb. 7th, 1887; Educ., 1 year applied science, Kings Univ., 2 years applied science, McGill Univ.; 1902 (summer), ap'tice., Windsor Foundry and Machine Co.; 1906-13, with N.T.C. Rly. as follows, 1906, topographer and dftsman., 1907-08, instr'man., 1908-12, res. engr., 1912-13. district "A" office engr.; 1913, supt., Rothesay Constrn. Co., Moose Jaw; 1913-14, asst. locating engr., Calgary & Fernie Rly., and High River and Hudson Bay Rly.; 1915, private practice, Nova Scotia; 1916, field engr., Norton Griffiths Co. St. John Harbour Constrn.; 1917, asst. production engr., British Ministry of Munitions, New Haven, Con.; 1918 to date, with Concrete Builders Limited, Fredericton, N.B. as follows, 1918, chief engr. and mgr., 1919-22, managing director, and at present, chief engr. and managing director.

References: C. O. Foss, G. C. Dunn, H. Longley, B. M. Hill, H. M. Marshall.

KERR—ADAM THOMAS, of Calgary, Alta. Born at Hampstead, N.B., July 4th, 1868; 1884-97, private study and engr'g. practice under direction of James Kerr, D.L.S. and C.E.; 1898-1900, asst. engr., Dept. Rlys. and Canals, Ottawa; 1901, asst. engr., Intercolonial Rly.; 1902 (Jan.-May), asst. engr., Cornwall Canal; 1902-04, asst. engr. on Trent Canal; 1904-07, engr. in charge of surveys, western out-let, Trent Canal, Orillia to Port Severn; 1907-11, divn. engr., Trent Canal constrn; 1911 to date, divn. engr., Board of Railway Commission for Canada, Calgary, Alta.

References: G. A. Mountain, A. J. Grant, T. L. Simmons, W. A. Bowden, L. Sherwood, J. G. Sullivan.

LAWRENCE—WILLIAM DAWSON, of 1 Carlton Road, Montreal, Que. Born at Maitland, N.S., Feb. 22nd, 1883; Educ., B.Sc. McGill Univ., 1904; 1902 (summer), transitman on survey of G.T.R. terminal site. Midland, Ont.; 1903 (summer), with John S. Metcalf Co. as res. engr. on constrn. of substructure of Windmill Point Elevator, Montreal, and 1904, design of grain elevator in Chicago office of same company; 1904-05, in charge of survey party on transmission lines and on power plant constrn., Shawinigan Water and Power Co., Shawinigan Falls, Que.; 1905-10, with J. S. Jamieson as designing engr. and supt. of constrn. on grain elevators and other engr'g. structures; 1911-18, private practice as consltg. engr. and contracting. Also managing director, Atkinson, Glasso Lawrence Ltd.; 1918 to date, superintendent engr. of McGill Univ. having direct supervision of the central light, heat and power station, bldgs., grounds, alterations, new constr., etc.

References: J. A. Jamieson, F. S. Keith, C. M. McKergow, C. M. Morssen, M. B. Atkinson, G. P. Cole.

RANNIE—JOHN LESLIE, of Ottawa, Ont. Born at Newmarket, Ont., May 27th, 1886; Educ., B.A.Sc., Univ. of Toronto, 1909, D.L.S., D.T.S.; 1903-04, rodman on C.N.R. constrn. and location; 1905 (6 mos), engr's. asst. on C.P.R. bridge constrn. over Sask.; 1906 (6 mos.), leveller, C.N.R. location party; 1907-13, observer on Geodetic Survey parties and International Boundary Survey Parties; 1913-15, in charge of survey work on Lake of the Woods for International Joint Comm'n.; 1915-17, in charge of survey parties on New Brunswick-Maine boundary; April 1917 to date, Supervisor of Triangulation for Geodetic Survey of Canada.

References: N. J. Ogilvie, J. J. McArthur, J. D. Craig, W. M. Tobey, F. B. Reid.

SEIBERT—FREDERICK VICTOR, of Ottawa, Ont. Born at Port Elgin, Ont., Nov. 8th, 1885; Educ., B.A.Sc. Univ. of Toronto, 1912; O.L.S., D.L.S., A.L.S., S.L.S.; 1909, sub-divisions surveys; 1910-11, base line surveys, 1912, misc. surveys, 1913-15, base line surveys; 1916, subdivision surveys, 1917, district engr., Prov. of Alta.; 1917-18, Pilot, R.A.F. (B.E.F.); 1919, investigation of reclamation of waste areas, western provinces and subdivision surveys; 1920, investigation of reclamation of waste areas, western provinces, 1921; exploration surveys, Mackenzie River, pipe line investigations, Mackenzie Oil Fields; At present on reports on work of summer 1921.

References: O. S. Finnie, G. H. Herriot, D. H. Nelles, F. H. Kitto, G. Hogarth, J. A. Stiles, J. L. Rannie, G. H. Blanchet.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE.

KENDALL—RALPH, of Glace Bay, N.S., Born at Louisburg, N.S., June 20th, 1889; Educ., 4 mos. special student, N.S. Tech. Coll. as graduate of complete civil engr'g. course, I.C.S.; 3 years rodman and picketman, N.T.C. Rly., Smith Kerry & Chace, Toronto, and Dom. Iron & Steel Co., Sydney, N.S.; 1½ years transitman, D.I. S. Co., Sydney, and Can. Steel Corpn., Ojibway, Ont.; 6 mos., concrete inspr., blast furnaces, open hearths and other steel plant constrn., D.I.S.Co., Sydney, N.S.; 3 years general dfting. and designing on steel plant work, Can. Steel Corpn., Ojibway, Ont.; 6 mos., constrn. engr. on turbo steam plant, and on a 12 story bldg. for Walbridge Aldinger Co., Detroit, Mich.; 5 years gen. foreman, asst. supt., and supt. on constrn. of rly. bridges, factory bldgs., dams, irrigation ditches and flumes and other gen. constrn.; 6 mos. chief of survey party, Can. Steel Corpn., Ojibway, Ont.; About 1 year erecting engr., on steam turbine install'n., and 5 mos. to date, constrn. engr., Dominion Coal Company, Glace Bay, N.S.

References: D. Morrison, K. H. Marsh, A. L. Hay, N. K. Hay, W. H. Baltzell.

MILOT—CAMILLE, of 29½ Cartier Avenue, Quebec, Que. Born at Yamachiche, Que., June 8th, 1892; Educ., B.A.Sc., (C.E.), Laval Univ. 1919; 1916 (summer), highway dept., Quebec; 1917-18 (summers), rodman, Quebec Streams Commission; 1919 (summer), levelman, Quebec Streams Commission; Feb. 1920 to date, with Dept. Public Works and Labour, Bridge Division, Quebec.

References: I. E. Vallee, J. M. H. Cimon, O. O. Lefebvre, E. S. T. Lavigne, A. B. Normandin, L. A. Dubreuil, F. T. Cole.

SMITH—ERNEST S., of 405 Janette Avenue, Windsor, Ont. Born at Sault Ste. Marie, Ont., March 21st, 1886; Educ., B.A.Sc., Univ. of Toronto, 1917; 1913-14 (summers), rodman and instr'man., Algoma Central Rly.; 1916 (summer), rodman and instr'man., with field party, Algoma Steel Corpn.; 1917-18, chief asst. to city engr., Sault Ste. Marie, Ont.; 1918 (May-Dec.), Lieut., Can. Engrs.; 1919, chief asst. to city engr., Sault Ste. Marie, Ont.; 1920, asst. to field engr., Algoma Steel Corpn.; 1920 (June-Dec.), with R. Westcott Constrn. Co. as engr. in charge fifty housing comm'n. units financed by the Windsor Housing Commission; May 1921 to date, chief asst. to R. W. Code, Windsor, engr., for the towns of Riverside, Tecumseh and Kingsville, Ont.

References: B. E. Barnhill, G. F. Horsey, A. G. Tweedie, J. B. C. Keith, C. H. Speer.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE.

BROUSE—ELDRIDGE DEAN GOODERHAM, of 71 Lowther Avenue, Toronto, Ont. Born at Toronto, April 3rd, 1894; Educ., B.A.Sc. Univ. of Toronto, 1915; survey work during college vacations; 1916-19, overseas; Lieut.; 1919 to date, vice-pres. and asst. gen. mgr., Norman McLeod Linited, Engr'g. Contractors, Toronto.

References: N. M. McLeod, T. D. Mylrea, C. R. Young, C. H. Mitchell, P. Gillespie.

CHAMBERS—HUGH DALFORD, of 5071 Sherbrooke Street West, Montreal, Que. Born at Truro, N.S., Jan. 29th, 1890; Educ., B.Sc., McGill Univ. 1914; Sept 1911, May 1920 Nova Scotia Steel and Coal Co., on machine shop work; 1914-15, lecturer in first and second year shop, asst. lecturer third year mech. engr'g., and demonstrator, mechanical laboratories, McGill Univ.,, 1915-17, with the N.S. Steel & Coal Co., as follows:—1915 (June-Dec.), in charge of heat treating dept. on munitions, 1915-16, asst. to mech. supt., 1916-17, efficiency engr., with charge of all power plant, testing and economical operation of same, etc.; 1917-19, overseas. Lieut. C.R.T 1919-20, investigating power plants in a consulting capacity in order to effect savings in coal consumption; 1920 (June-Dec.), sale engr., and 1921 (Jan.-July), chief engr. on design and constrn. of all types of industrial furnaces for forging, heat treating and annealing steel and other metals; Jan. 1922 to date, manager, Canadian office, G. D Peters & Co., Ltd., of London, England.

References: C. M. McKergow, R. E. Chambers, C. L. Cantley, E. H. Morley N. M. Campbell.

DESJARDINS—OLIVIER, of Quebec, Que. Born at Montreal, Que., Aug 3rd, 1895; Educ., B.A.Sc. Ecole Polytechnique, 1919; 1915 (summer), with Ouimet & Lesage; 1916 (summer), rodman, G.T.R.; At present civil engr., Quebec Provincia Govt., Dept., Public Works, Bridge Division, Quebec.

References: I. E. Vallee, E. S. T. Lavigne, J. N. H. Cimon, L. A. Dubreuil, F. T Cole, A. B. Normandin, R. Lesage.

DOWNIE—RALPH WALDO, of Thorold, Ont. Born at Sourisford, Man., July 7th, 1891; Educ., B.A.Sc. Univ. of Toronto, 1921; 1913-14 (summers), with Dept Lands, Forests and Mines, Ont. as asst. engr. on colonization roads in Rainy Rive District, 1914-16, overseas. Can. Engrs.; 1917-19, officer in charge of stores and accounts R.C.E., M.D. No. 5, Quebec; 1920 (summer), inspr., Can. Inspection and Testing Co. Ltd., Toronto; 1921 to date, tester of building materials, Welland Ship Canal In charge of testing laboratory for cement, concrete and concrete materials.

References: A. E. Doucet, C. H. Mitchell, T. R. Loudon, R. J. Marshall, A. J Grant, F. S. Lazier, H. E. T. Haultain, W. J. Francis.

ROBERTSON—CHARLES FORMAN, of Halifax, N.S. Born at North Sydney N.S., Oct. 23rd, 1894; Educ., B.Sc., N.S. Tech. Coll., 1921; Four summer vacations tracer in dfting. room, N.S. Steel and Coal Co., Sydney Mines, N.S.; 1921 (Aug.-Dec.) inspr., for Jackson & Moreland, Engineers, Boston, Mass., taking inventory of Nova Scotia Tramways & Power Co's. Plant, Halifax, N.S.; At present, asst. to supervisor of mtce., Maritime Telegraph and Telephone Co. Ltd., Halifax, N.S.

References: F. R. Faulkner, F. A. Bowman, P. A. Freeman, C. M. Crooks, I. P MacNab.

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THE JOURNAL OF
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CONTENTS

Volume V, No. 6

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VOLUME V MONTREAL, JUNE 1922 NUMBER 6

The Self-Corrosion of Buried Lead Pipes

An Investigation into the corrosion of buried lead pipes in Winnipeg and vicinity, with Laboratory Experiments on the self-corrosion of lead.

W. Nelson Smith, M.E., M.E.I.C.,
Consulting Electrical Engineer, Winnipeg Electric Railway Company.,

and

J. W. Shipley, Ph.D., F.C.I.C.,
Assistant Professor of Chemistry, University of Manitoba.

Paper read before the Winnipeg Branch, The Engineering Institute of Canada, April 6th, 1922.

Reasons for the Investigation.

The occasion of this inquiry into the self-corrosion of lead was the destruction, regardless of location, of a considerable number of lead water service pipes in various parts of the city of Winnipeg. For lack of any more scientific analysis, the damage had formerly been attributed solely to leakage of stray current from the electric railway system but the indisputable fact that a number of these cases of damage had occurred in place either remote from railway substations or at a considerable distance from any grounded metallic conductor of lower potential, coupled with the fact that the clay and limy silt soils of the entire region are thoroughly permeated with solutions of alkaline salts, prompted the suspicion that stray current could not always be blamed for the corrosion and provided a sufficient incentive to investigate the action of these salts upon metallic lead in the absence of outside impressed electromotive forces.

The present paper is intended to comprise a general review of facts derived from local observations by ourselves, and from observations by others on the corrosion of lead, placing the same alongside of the experiments we undertook to demonstrate the conditions under which the self-corrosion of lead takes place in the alkaline soils at Winnipeg and vicinity.

Ever since the electric railway came into existence, more than thirty years ago, it has been usual to assume that stray railway current is the first thing to suspect, in accounting for the corrosion of buried pipes. It is a very convenient theory: first, because it has acquired considerable prestige by having been frequently proved to fit the facts; second, because the unknown locations and resistances of invisible underground paths for railway return

current immediately suggest that anything becomes possible when a stray current in the earth seeks and finds the path of lowest resistance back to the nearest station.

It has also been easy for scientific experts to take the stand that the natural difficulties of the situation make it impossible to make measurements that are not misleading. Consequently, there has developed a habit of neglecting the fundamental necessity of proving the positive polarity of a metal pipe to the surrounding earth, which is admitted by the experts to be a prerequisite to the possibility of the said pipe being corroded by the leakage of stray current. To ignore the necessity of this proof, is like having one's cake and eating it too.

However, it has at least been recognized that a test of polarity, or its equivalent is a scientific necessity. Furthermore, as the study of electro-chemistry has been considerably advanced in the past thirty years, it is now possible to deal on an electro-chemical basis with a problem that is electro-chemical, if it is anything.

In a former paper* was demonstrated the fallacy of believing cast iron indestructible under all conditions when buried in the ground. The present paper is prepared in order to set forth corresponding facts about metallic lead, and to show the paramount importance of determining the polarity of buried pipes to the surrounding earth, before attempting to fasten the responsibility for their corrosion upon stray railway current.

Indications of Self-Corrosion on Pipes in and about Winnipeg.

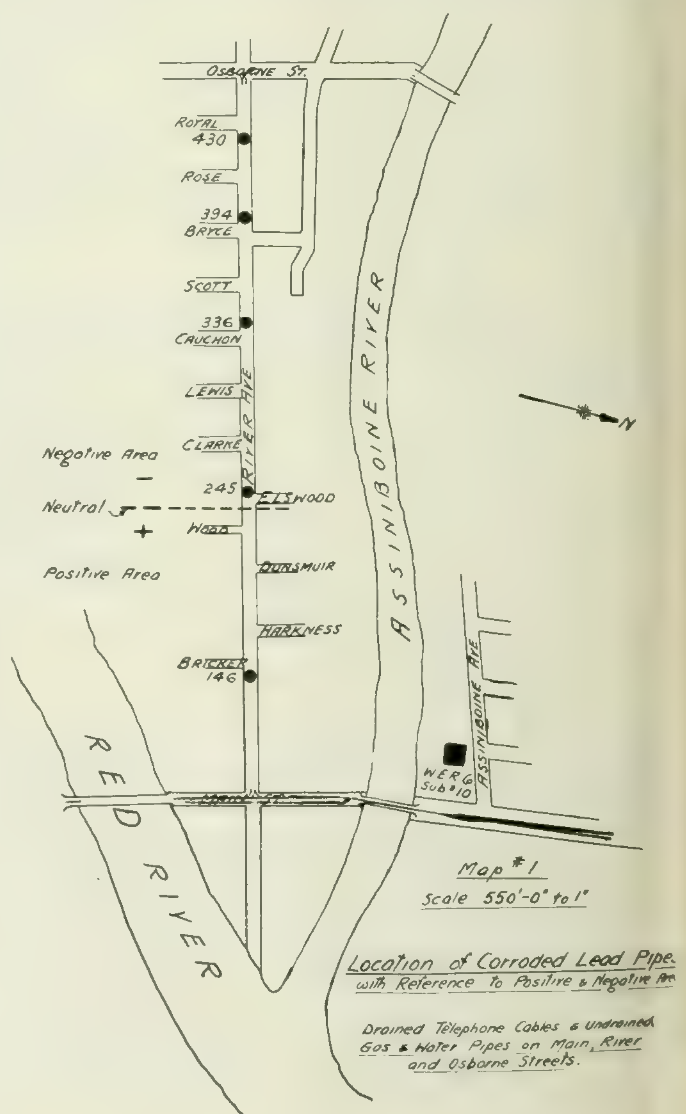
Pipes have corroded at various times in the past at a number of places scattered indiscriminately over the city, in localities where the electrical polarity of pipes to earth, if there was any at all, must have been negative, insofar as concerns the general direction of whatever stray current may have existed.

In a negative district, it has to be admitted that whatever stray current there may be tends to flow *into* underground conductors, and not *out* of them. If cables are present which are drained to a power station it is sometimes possible for pipes to be positive to cables, but the cables cannot even then be claimed to endanger the pipes unless they are within a few feet of them, as in the case of a cable conduit running over a service pipe where the latter crosses the street. The Winnipeg soil is of such low average resistance that it tends to cause a much smaller flow of stray current in underground pipes than would otherwise be the case.

Generally speaking, as much or more pipe corrosion has occurred in negative or neutral than in positive districts, irrespective of whether underground cables were near or distant. Observation of pipes exposed in River avenue was of considerable interest in this connection and is here referred to in some detail because of the evidence, offered by both iron and lead pipes, that some other cause than stray current is responsible for most of the corrosion observed.

*Self Corrosion of Cast Iron and Other Metals in Alkaline Soils,—The Engineering Journal—The Journal of the Engineering Institute of Canada, October, 1921.

In June 1921, the city Water Department changed a the service pipes on River avenue from the old four-inc cast iron main installed prior to 1890, to a newer six-inc main installed about 1916, affording excellent opportun ities for examining both the iron and the lead pipes Careful examination was made jointly by representative of the city and the railway. The lower end of Rive avenue, east of Elswood street, had probably been in positive area with respect to the old railway substatio on Assiniboine avenue, but west of Elswood street th pipes were shown, by a survey made as long ago as 1914, t have been negative to the rails. Nevertheless, the iro mains were corroded more or less indiscriminately withou regard to their location along the street; some of the wors corrosion being at the west end of the street furthes from the former positive area, in spots where the soi were found to be heavily charged with alkaline salt The observed cases of incipient corrosion of lead pipe (all the services in the street were examined), include only one at the east end of the street in the former positiv area, and four in the western portion in the former negativ

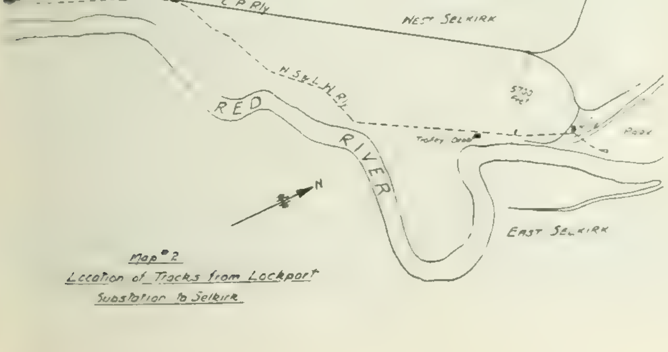


area, being respectively west of Elswood, Cauchon, Bryce and Rose streets. The damage to the iron pipes was not all confined to the bell and spigot joints, which might have been expected had the pipe been actually known to carry any quantity of stray current, but was observable *anywhere* along the pipe. Some of the damage on the iron pipes appeared in the form of a groove, encircling the pipe, which bore every evidence of having been the sling mark of the rope used in lowering the pipe into place. This feature has been observed on corroded iron pipes in many other localities about the city and points conclusively to soil corrosion as the cause of this form of disintegration of the wall of the iron pipe.

Neither was there any definite relation between the corrosion of the lead pipes and those of the cast iron mains. At some points examined the iron pipes were found to be badly attacked, and the lead service pipes connected thereto showed no evidence of corrosion whatever; while in other excavations, the lead service pipes were corroded right up to the iron mains and the latter showed no marked signs of damage at that particular spot.

It has been found in other cities that, on cast iron mains known to be carrying stray current, pitting is unmistakably present at and near the joints while absent between joints. This is because of the usual higher resistance of lead-caulked joints which diverts stray current from the pipe into the surrounding earth and corrodes the pipe for a distance of one to two feet back of the joint.

The occurrence of corrosion here and there on the River avenue water mains, without regard to location of the pitting with respect to pipe joints, shows that the pipe cannot have carried any appreciable amount of stray current, although it lay in the same street with the oldest electric railway line in the city. The absence of destructive corrusion in the lead service pipes, which cross the street directly under the electrically drained telephone cables which run along the centre of the street, also shows that these cables, although their sheaths undoubtedly conducted some current to the substation, could not have been draining any appreciable amount of stray current out of either the mains or service pipes in the street. Otherwise there would have been extensive and continual damage to the lead service pipes crossing the street, which has never been the case so far as our records indicate. Lead is more than three and one-half times as sensitive to stray current corrosion, as cast iron,



Map No. 2
Location of Tracks from Lockport Substation to Selkirk

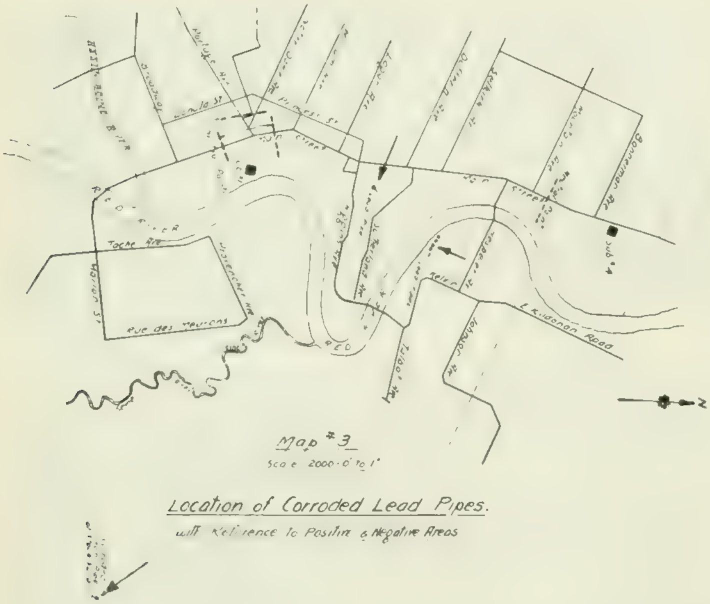
so that the absence of its destruction where it would be most expected, within 1,500 feet of the oldest power station in town, is fairly good evidence that stray current has played little if any part in the corrosion observed in this street. In the following tabulation of observed corroded spots, only the first location has been in an electrically positive area.

Table A.—Points at which corrosion was observed.

Location	*Date*	*Remarks*
At Bricker street.	June 9, 1921	Lead pipe badly pock-marked. Soil dark limy silt, not saturated. Moisture in soil 22½% and 17½% for 2 samples.
At Elswood street.	June 16, 1921	Lead pipe covered with black deposit. Soil mixed limy clay loam, wet.
At Cauchon street.	June 18, 1921	Black warts on lead service pipe. No corrosion on iron pipe. Soil clay with limy silt, wet.
At Bryce street.	June 23, 1921	Lead pipe showed black carbuncles and white incrustation in pock-marks. Soil dry limy silt.
At Rose street.	June 25, 1921	Lead pipe blackened for 18 inches from water main, clean beyond. Soil very limy dry silt. No corrosion of iron pipes.

In January 1921, a lead pipe was uncovered at the Mental hospital in Selkirk, Manitoba, which had been recently perforated by corrosion, The perforated section was not available but the pipe was uncovered close by and corrosion was found to have started on the section which was examined. While the corrosion had not proceeded to any depth, it had gone far enough to disintegrate the exterior surface of the pipe and some particles of the surface metal were adhering to the matrix of the soil on the pipe. This corroded material was a lead compound insoluble in dilute nitric acid, presumably lead peroxide, P_bO_2, but there was not enough of it to make an analysis. The soil about the Selkirk hospital is mostly of the character of limy silt or disintegrated pulverized limestone, and there was also evidence of decaying organic matter in the backfill. The section of pipe that had been actually perforated, had unfortunately been lost before this investigation, but the section of pipe secured was certainly corroded.

The isolation of the Selkirk hospital waterworks system is of itself a sufficient guarantee of the impossibility of stray current being responsible for pipe corrosion, as stray current would have to double back on its own track to get into the pipes and out of them again in order to be held responsible for the corrosion. (see Map No. 2) A delicate galvanometer test failed to disclose any evidence of stray current



Location of Corroded Lead Pipes.
with reference to Positive & Negative Areas

Almost equally striking are four cases which occurred in Elmwood, across the Red river from Winnipeg, (see Map No. 3). These were all lead service pipes on the same street, (Riverton avenue), from five hundred to one thousand feet distant from the nearest track, which was in a distinctly negative area, one and one-quarter mile distant from a substation in either direction, and with no gas pipes in the district and no telephone cables within one thousand feet, to which any stray current could possibly leak from these pipes. The cast iron water main on that street has never required repairs. The soil here is also of the limy silt character so frequently observed in connection with most cases of lead pipe corrosion. With the electric railway distribution conditions identically the same as at the time the pipes were perforated, the galvanometer test for polarity at this spot showed the water main distinctly negative to the earth.

The polarity tests above mentioned were made with the equipment suggested by the United States Bureau of Standards, which comprises a pair of non-polarizable terminals and a high resistance galvanometer of the Leeds and Northrup portable type. The two galvanometer terminals are of copper enclosed in insulating bushings of bakelite with the open ends protected with plugs of Portland cement, which prevent the copper terminals from being affected by abrasion or oxidation. The two terminals are mounted about eight inches apart at the end of a piece of gas pipe through which the galvanometer leads are carried, the pipe being lowered into an augerhole bored in the ground almost down to the pipe. The presence and polarity of any appreciable difference of potential between pipe and earth is thus very promptly indicated by the galvanometer.

It should be understood that the cases of lead pipe corrosion, observed on River avenue, were all in very early stages, none being far enough advanced to require repairs. The cases herein reported from other localities, in and near Winnipeg, by no means cover the total corrosion damage but are simply the most outstanding instances of damage where the evidence preponderated in favour of self-corrosion and against the possibility of stray current corrosion.

Other Reported Cases of Self-Corrosion of Lead.

Lead pipes have been used for conveying water for many centuries. They are known to have been used in Rome about the year 100 A.D. In 1236 London was supplied with water from Tyburn which was brought through a lead pipe. In more modern times, since the art of casting iron into pipe was developed, the advance of chemical and medical science has brought about greater caution in the use of lead for water supply piping, as it has sometimes been found to be soluble in available surface waters and the soluble salts of lead are all too poisonous to be permissible in a city water-supply. Consequently, a large part of the research on the corrosion of lead has been more along the lines of ascertaining the causes of internal corrosion of lead pipes, rather than external corrosion.

References to the external corrosion of lead are not frequent in engineering literature, but a persistent search has nevertheless disclosed some recorded facts of interest. The following is from the Journal of Gas Lighting, November 26th., 1912, published in Berlin, Germany:—

> "Corrosion of Lead Pipe.— Lead pipe corrosion of a somewhat unusual nature was observed on some sections recently uncovered in the grounds of the Technical High School at Charlottenburg. The pipe had been in the ground for about twenty-four years, part of it being unprotected and part embedded in a cement foundation. The unprotected portion was found to be in a practically perfect state of preservation but the other part showed a peculiar transformation. The contact between the pipe and the cement was not uniform and where the pipe entered the mass the lead was transformed into a hard compact yellow-red substance. When this was removed and a section of the pipe not affected in this way was exposed, the latter was found to have a scarred surface, with silver-white lustre, which rapidly changed to a dull grey in air. The pipe was 0.7 inch in diameter and about 0.2 inch thick. An examination of the affected section showed the transformed mass to be made up of concentric alternating red and yellow layers, twenty four red and twenty-three yellow, or one pair for each year the pipe lay in the cement. Analyses showed the two substances were the low and high oxides of lead, (PbO and Pb_3O_4), and the supposition was that the seasons influenced the formation of the oxides. Thus, during the months of high precipitation more active oxygen would be present, which would result in forming the higher oxide, (Pb_3O_4), while the lower one would be deposited in the drier season." *Journal of Gas Lighting, 120, 669, November, 26, 1921.*

An article by Mr. Richard H. Gaines, chemist of the New York Board of Water Supply, published in the Engineering Record in June 1913, mentions a number of instances of the self-corrosion of lead. One case was that of lead pipes in contact with a wet concrete floor, in a bath house in Brooklyn, which resulted in the hot water pipe

being nearly destroyed in five years and the cold water pipe deeply corroded. Another instance was given of lead pipes in a suburb of New York city, not exposed to stray current, becoming so badly pock-marked that they had to be replaced. Another instance was given of the grease on cartridges having converted lead bullets into white lead, the expansion of which had burst the cartridge shells by the resulting increase in volume of the lead. The lead of old coffins had been found converted into a mixed mass of metallic lead and basic carbonate. Mr. Gaines described some experiments which consisted in embedding samples of different metals in damp concrete for a period of two months. Where the metals were separated from each other, the lead lost 11.99 grams per square foot, while manganese bronze lost only 0.32, steel 0.135, copper 0.64 and monel metal 0.04 gram. With steel, lead and copper in contact, the lead lost 6.77 grams, the steel 2.48 grams and the copper 0.31 gram per square foot. Mr. Gaines also recorded information ascertained from a Russian engineer who visited the United States some years ago, who stated that lead pipes forming a part of the water-supply system in a section of St. Petersburg, laid about 1860, had corroded to destruction by some time in the seventies. This was attributed to soil corrosion, as it was years before the days of applied electricity and stray currents were out of the question.

Messrs. Scofield and Stenger, in an account of their research upon self-corrosion of metals published in the Electric Railway Journal of November 14th, 1914, cited a case, of which a photopraph was given, exhibiting the corrosion of a lead pipe that had been buried in contact with a mixture of earths of different character. The corrosion is so distinct as to leave no doubt of the corrodibility of lead under such conditions. These experiments were conducted with soils from the vicinity of Minneapolis, Minnesota.

The corrosion of lead pipes by pure distilled water is an occurrence well known to chemists, though not so well known to engineers, and an example is available of a lead plate actually corroding in distilled water, corrosion being well advanced in several spots after about four months immersion.

The writers once came across an instance of internal corrosion by condensed steam in heating coils made of extra heavy lead pipe, and used for heating phosphoric acid in a chemical works by means of live steam conducted through the pipes. The drip, or condensate, from these pipes carried a cloudy precipitate which proved to be chloride of lead. No phosphoric acid was present, showing that the pipe had not been perforated by the acid to which it transferred heat. There was known to be a slight amount of chlorine in the boiler feed-water and this was thought to account for the precipitate of lead chloride observed in the condensate.

Causes of Self-Corrosion of Lead Compared with the Natural Conditions. Where it occurs.

Pure water, especially when containing dissolved oxygen, can dissolve lead, forming lead hydrate, and the CO_2 from the air or any other source changes this hydrate into insoluble basic lead carbonate. This carbonate may form a thin film which acts as a protection against further action, but further conditions may arise which cause the action to be continued. The course of these reactions may be represented by the following chemical equations:

$$Pb + O = PbO$$
$$PbO + H_2O = Pb\,(OH)_2$$

$$3\,Pb\,(OH)_2 + 2CO_2 = 2\,PbCO_3.\,Pb\,(OH)_2 + 2H_2O.$$

If a soluble sulphate is present, some of the hydrate may be transformed into lead sulphate, in accordance with the following equation

$Pb(OH)_2 + MSO_4 = PbSO_4 + M(OH)_2$ where M may represent calcium or any other base forming metal. Lead sulphate is very little soluble in water at ordinary temperature.

The hydrate condition may be said to represent the tendency of lead to form a basic compound. This tendency to form a compound with an acid radical is instanced by the so-called Dutch process of manufacturing white lead, in which metallic lead is the raw material and is deliberately corroded into the carbonate, which is the white lead of commerce. The Dutch process consists of placing a strip of lead around the upper inside of an earthenware jar containing acetic acid in the bottom. This jar is buried in manure or rotten tan bark for about twelve weeks when the lead is found to be completely transformed into white lead, which is basic lead carbonate. The decomposing organic matter produces heat which volatilizes the acetic acid and the acid vapour attacks the metallic lead, the first product being the lead acetate. The decomposing organic matter at the same time produces CO_2 ,which acts upon the lead acetate, turning it into lead carbonate. The reactions are as follows:—

(1) $2HA + 2Pb + O_2 = PbA_2.Pb\,(OH)_2$ (basic lead acetate)

(2) $3[PbA_2.Pb(OH)_2] + 2CO_2 = 3PbA_2 + 2PbCO_3.PbOH_2 + 2H_2O$

(3) $2PbA_2 + 2Pb + O_2 + 2H_2O = 2[PbA_2.Pb(OH_2)]$

A small amount of acetic acid will thus serve for the manufacture of an indefinite amount of white lead. The same lead acetate is constantly ready to combine with lead and oxygen over and over again.

It is thus evident that both pure water and decomposing organic matter are capable of corroding lead, each in a manner slightly different from the other, but the final product under these circumstances is invariably a mixed carbonate and hydrate of lead, sometimes with sulphate of lead present if soluble sulphates are present in the soil. Lead is less easily corroded by the stronger mineral acids than it is by the weaker organic acids and the evolution of the latter, by the decomposition of organic matter, probably accounts for the initial acid action in starting corrusion of the lead; but as carbon dioxide is evolved by the same decomposition, the final products of the corrosion appear as basic lead carbonates, just as in the case of the deliberate corrosion of lead by the Dutch process of white lead manufacture.

From observations, in and about Winnipeg, it appears that the corrosion of lead is most likely to occur where the soil is of the limy silt character and lighter in colour than the dark olive-brown stratified clay which is so often

heavily loaded with the sulphates of calcium and magnesium. Apparently the soil does not have to be highly saturated with moisture in order to be corrosive. The cases in Selkirk and in the Elmwood district, above recorded, were in comparatively dry limy silt soils.

A particularly suspicious locality is on Maple street, (see Map. No. 3), where the service pipe, supplying the stable of the Vulcan Iron Works, has been destroyed several times. This is in a distinctly negative area two or three blocks from the nearest car track and about half a block from the nearest underground cable. Being in proximity to a stable, where the soil can be presumed to be more or less polluted with decomposing organic matter, would undoubtedly account for the evolution of the organic acid ingredients that would attack lead.

Some other cases of lead pipe corrosion, that have occurred near electric power stations, have also been in the same type of light coloured limy silt soil, not always dry, and with sulphates and chlorides present also. The products of corrosion adhering to the pipes in the latter places were sulphates and carbonates of lead.

This paper will be continued in the July issue of *The Engineering Journal.*

220,000-Volt Transmission and Apparatus

The Field of Application of 220-kilovolt Transmission, Description of Equipment, and Reference to Two 220-kilovolt Systems under Construction in California.

J. F. Peters, Member A.I.E.E.

Paper read before the Hamilton Branch, The Engineering Institute of Canada, March 24th, 1922.

The rapid increase in demand for electric power is requiring rapid increases in transmission voltages. Twelve or fifteen years ago an operating voltage of 100,000 volts was rare, today 130 kv., is common and 150 kv., is being used rather extensively. Recently 220 kv. transmission has been the subject of considerable discussion. At the present time two companies on the west coast are building 220 kv., lines and are installing apparatus to operate at that voltage. A logical choice for the next step in the transmission schedule appears to be 220 kv., because from an appraisal of the general situation, a voltage of this order is adequate for the present needs and commensurate with expected growth in transmission service for some time. The numerical value of 220,000 is in accord with the well established practice of standardizing in multiples of 11,000.

The field of 220 kv., is perhaps not broad; its commercial application is primarily to large blocks of power and long transmission distances. Power from large hydro-electric stations or from steam-electric stations, in coal fields, would advantageously be transmitted over 220 kv., lines to terminal substations at important load centers and then be distributed at intermediate voltage of 66 kv., or 100 kv. A 220 kv., system, with the generating stations for which it would be the outlet represents a tremendous amount of power. The economical importance of relialibity and continuity of power, in view of the great volume of industrial enterprises and public utilities which would depend on it, is of so high an order that more than usual care in the design and construction of the line and connected apparatus is justified. The neutral of the system should be solidly grounded. Transformer neutrals at all connected points should be solidly grounded on the 220 kv. side. This not only shows a distinct gain in dependability of operation but has considerable effect on the requirements of the line and the size, cost, and performance of connected apparatus, especially transformers. When the neutrals of all transformer banks are solidly grounded, the neutral end of each transformer phase remains at ground potential at all times, therefore very little insulation is required between this end of the high voltage winding and iron. The line ends of the phases remain at star voltage above ground when one line becomes accidentally grounded, whereas if the neutral is free or grounded through an appreciable impedance the neutral end of the phases would go to approximately star voltage above ground and the line end to line voltage, or $\sqrt{3}$ times star voltage from ground. Therefore solidly grounding the neutral not only decreases the necessary insulation on the neutral end to approx-

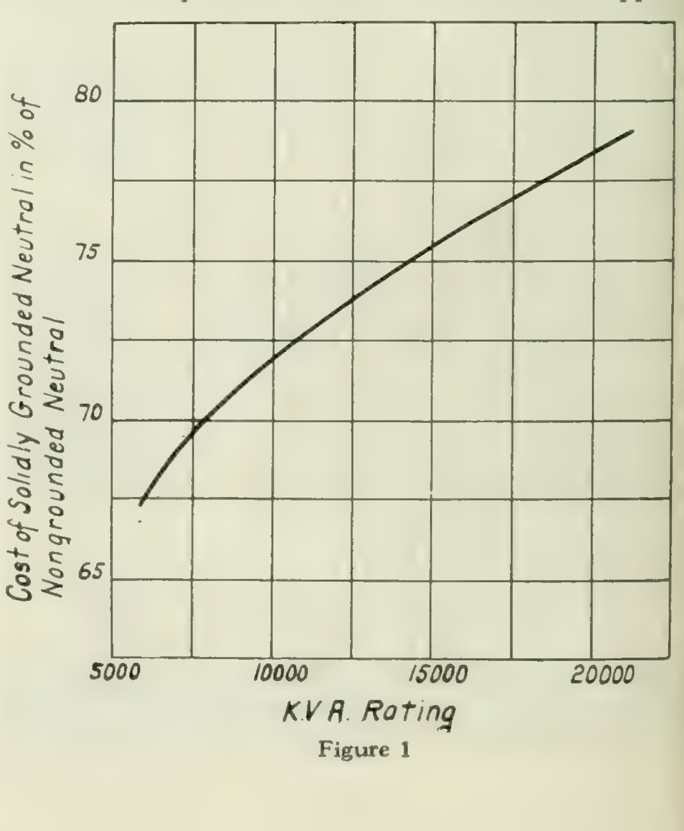


Figure 1

imately zero, but it decreases the necessary insulation at the line end considerably. It has become more or less standard practice to give transformers for solidly grounded neutral service an insulation test of 2.73 times star voltage instead of 2 times line voltage, or 3.46 times star voltage, which is the standard test for transformers not having their neutrals solidly grounded; the tests for grounded neutral units being by an induced voltage.

Figure 1 shows the relation between cost of 60-cycle, 220 kv., transformers for solidly grounded neutral service and transformers that have their neutrals grounded through comparatively high resistance. This curve applies to shell type transformers, but the relative costs of core type transformers are approximately the same. The difference between the grounded and ungrounded neutral transformers is a function of both voltage and capacity. It becomes more marked as the voltage increases and capacity decreases.

Transformers for 220 kv., should be built in as large units as possible as their costs per kv. a., at such voltages decrease very rapidly as their kv. a., ratings increase. They should be single-phase so as to facilitate shipping and handling. Three-phase units of large ratings show practically no saving in cost and efficiency over three single-phase units having the same bank capacity and are difficult to handle.

When transformers are located in substations where synchronous condensers are installed it is often possible to effect a considerable saving by having the transformer which would be required for the synchronous condensers combined with the main step-down transformer. When the condenser is supplying leading kv. a., and the main load is at lagging power factor, the two loads combine to reduce the current in the primary so that the addition of the condenser winding will not increase the size of the primary winding as long as the condenser does not exceed twice the reactive component of the main load. If the condenser load were maintained at all times it would even be possible to reduce the size of the primary. This is seldom the condition, however, and it is therefore the practice to design the primary so that it will carry full load with the condenser shut down.

Figures 2 and 3 show a 16,667 kv. a., single-phase, 60-cycle transformer unit designed for solidly grounded neutral service. Seven such units were built by the Westinghouse Electric and Manufacturing Company for the Pacific Gas and Electric Company, and are for 220 kv. service. Recently the Westinghouse Electric and Manufacturing Company has received an order from the Southern California Edison Company for six larger units. They will be 36,700 kv. a single-phase, 50-cycle,

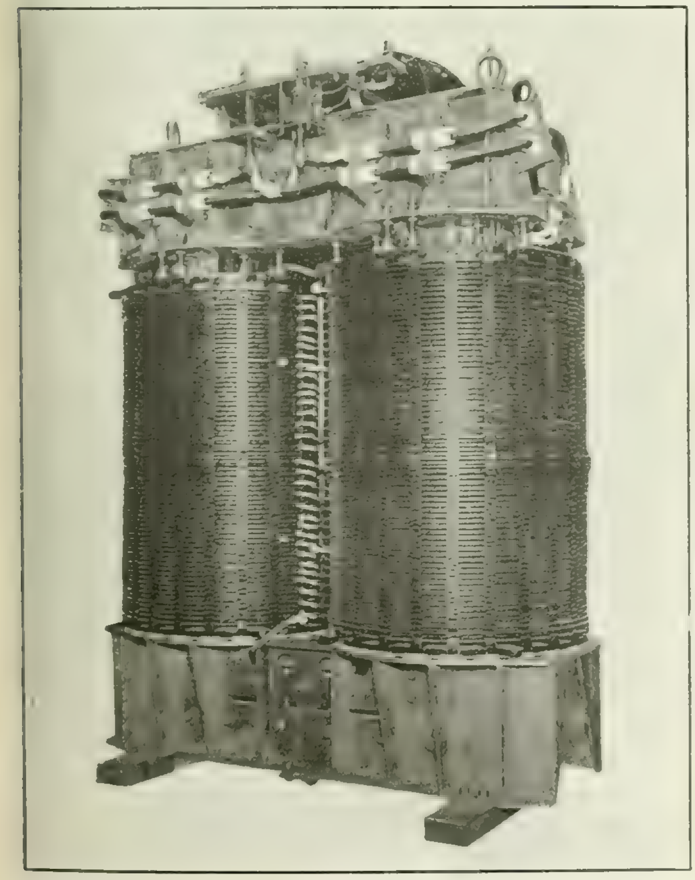


Figure 2. Transformer completely assembled. View from low and voltage side.

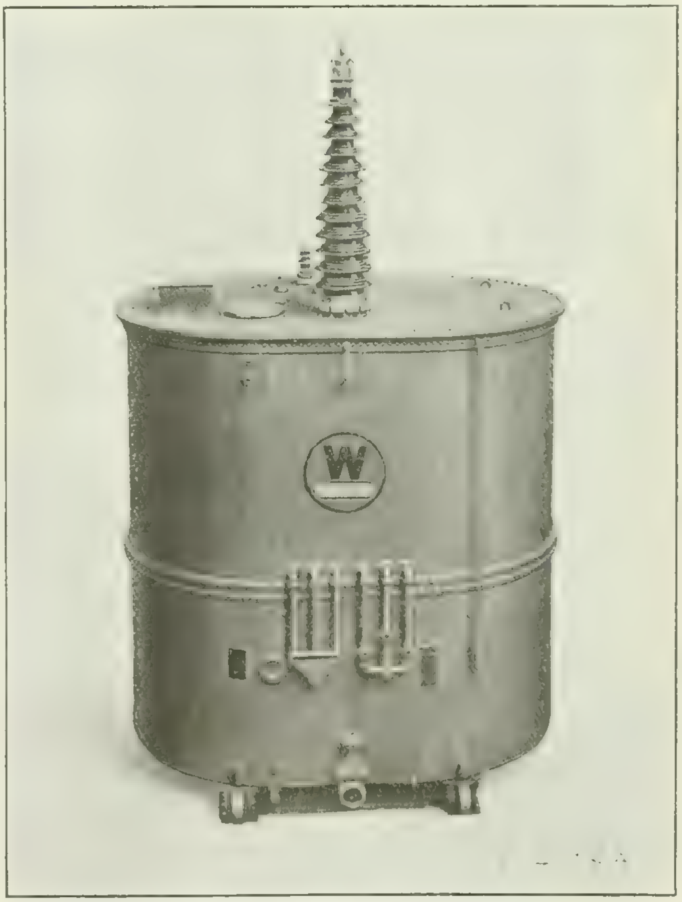


Figure 3. 16,667-K.V.A., 220,000-V., 60-Cycle, Transformer.

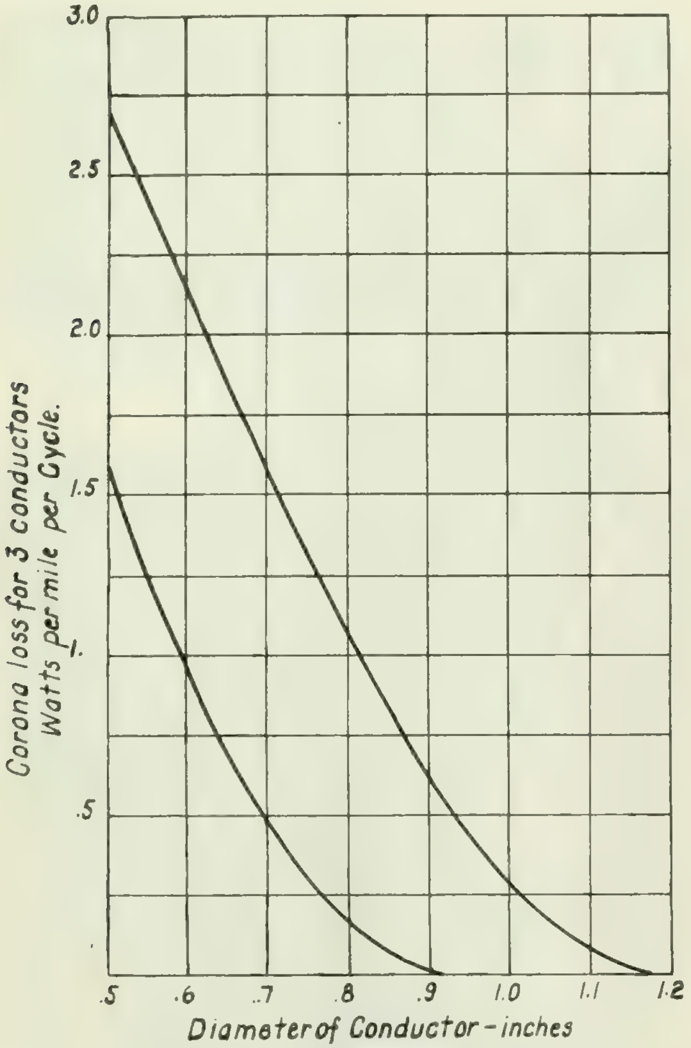


Figure 4

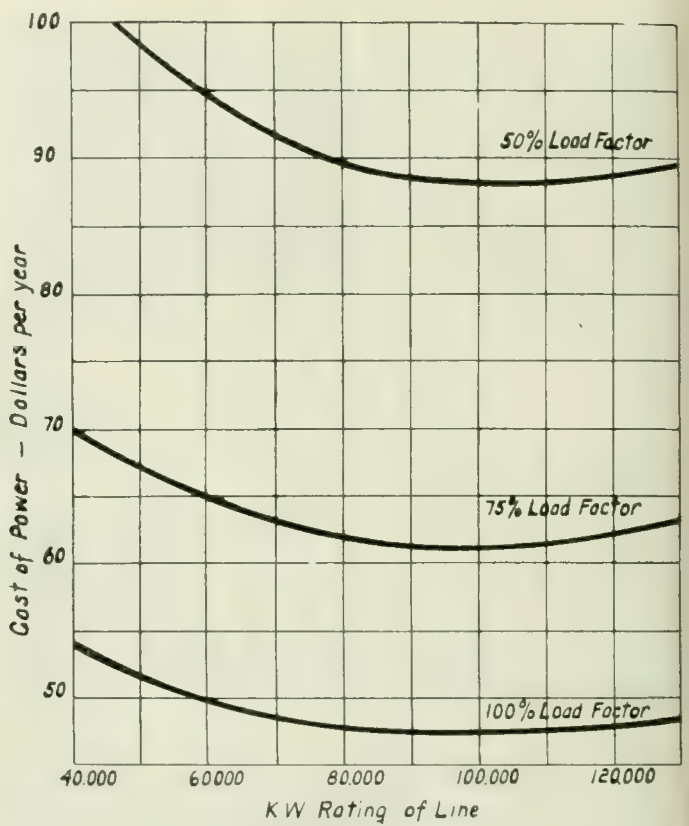


Figure 5

220,000 to 150,000 volts, and will be of the shell type construction.

There are many details that must be carefully considered in designing the lines for 220 kv., transmissions. Some of these, such as length of span, tower design, material in conductors, etc., will not be discussed in this paper. It will be confined more to the electrical features.

One of the primary considerations in selecting the conductor for 220 kv., transmission is corona formation and corona loss. This subject has been extensively treated by F. W. Peek, Jr., and others. In Figure 4, is plotted corona loss against diameter of conductors for both fair weather and storm conditions. These data are based on a flat conductor spacing of 15 feet, 1000 feet altitude, 28.7 inches barometer, pressure irregularity factor, 0.85, storm factor 0.8, temperature 50°F., and give the loss per mile for three conductors per cycle. These curves indicate that the conductor should not be less than approximately 1 inch in diameter.

It is always necessary to maintain approximately constant voltage at the receiver end of transmission lines. This is accomplished by means of synchronous condensers, generally located at the receiver end. In some cases, for very long lines, it may be found necessary to distribute the condenser capacity along the line at several points. Two hundred and twenty kilovolts does not introduce any new problems in connection with voltage control: it merely requires greater condenser capacity.

Since the smallest conductor that can be used on account of corona formation is fairly large and, when made in the usual form and of aluminum or copper, has considerable current capacity, it is interesting to determine the amount of power that can be most economically transmitted over the smallest conductor permissible, due to corona formation. The curves in Figure 4 indicate that the conductor should not be less than approximately 1 inch in diameter. Data were prepared and plotted in Figure 5 on the variable factors that enter into the cost of power transmitted 200 miles from the hydro-electric station over one circuit at 220 kv., 60-cycles. These data are based on the following:

Conductor: aluminum steel, 1.092 inch diameter, 0.115 ohms per mile.

Spacing: 15 feet flat.

Supply voltage: 220 kv.

Receiver voltage: 220 kv.

Cost of losses: 0.5c per kw. hour.

Capitalization: 15%.

Cost of station, including generators: $200 per kv.a.
Cost of synchronous condensers: $4.50 per kv.a.
Cost of transformers: $2.00 per kv.a.
Cost of transmission line without conductors but including towers, insulators and right of way: $15,000 per mile.
Cost of conductors: $4,700 per mile.
Generator losses at full load: 3.7%.
Condenser loss at rated load: 3%.
Transformer loss at full load: 1.3%
The curves are for a delivered load at 85% power factor and for 50, 75 and 100% load factors.

To determine the cost of electric transmission a large number of items have to be considered, many of which depend upon local conditions. The curves in Figure 5 can only be accepted as a more or less typical case. Another approximation that is imposed on this investigation is the assumption that both the generating and substations are large and have a number of transmission circuits between them, thus making the cost per kv.a., of generating station practically independent of the amount of power transmitted over one circuit. The curves in Figure 5 are given for 50, 75 and 100% load factors and, since the lower load factors, 50 and 75, depend upon load curves, an explanation of how the losses for these curves were obtained is in order. The losses at various loads including zero load, were computed for four normal ratings, 50,000, 70,000, 100,000 and 130,000 kw, 85% power factor, and were plotted in Figure 6. For the 50% load factor, it was assumed that the load varied between zero and normal, each fractional load being delivered for equal increments of time. The lossess for these increments of time were then summed up and divided by the number of increments: thus the average loss was obtained, which was approximately 15% higher than that corresponding to one-half load. For the 75% load factor the load was also assumed to vary from zero to normal but the increments of time increased in value as the fractional loads increased. The loads corresponding to equals increments of time were then determined, the losses summed up, and the average obtained. The average loss for 75% load factor by this method was 8 to 14% higher than that corresponding to three-quarters load.

In a long high voltage transmission line the charging kv. a., may be an important element in the choice of generating units. It may even fix the minimum size of machine that will give stable operation. Since a machine of normal design will carry only 40 to 50% of its rated capacity at 0% power factor leading, it may be necessary where moderate sized units are used to operate two machines in parallel for each line to obtain stability at light loads. For the line investigated above, if the receiving end of the line is open 30,000 kv. a., at 90% voltage will be required to charge the line and maintain a normal voltage at the receiving end. This would require an abnormally large machine of 60,000 kv. a., or two machines of 30,000 kv. a., each of normal design on one line to maintain stability. This more or less extravagance in generating capacity on a lightly loaded line can be pre-

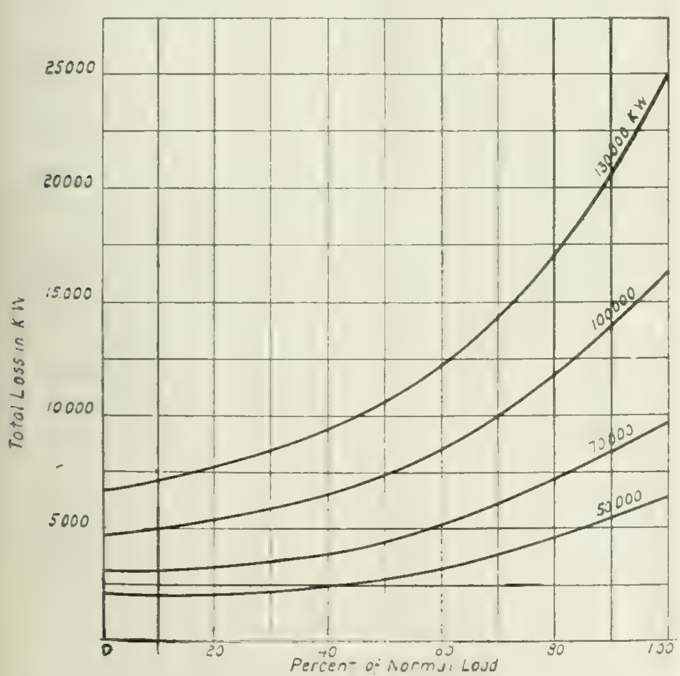


Figure 6

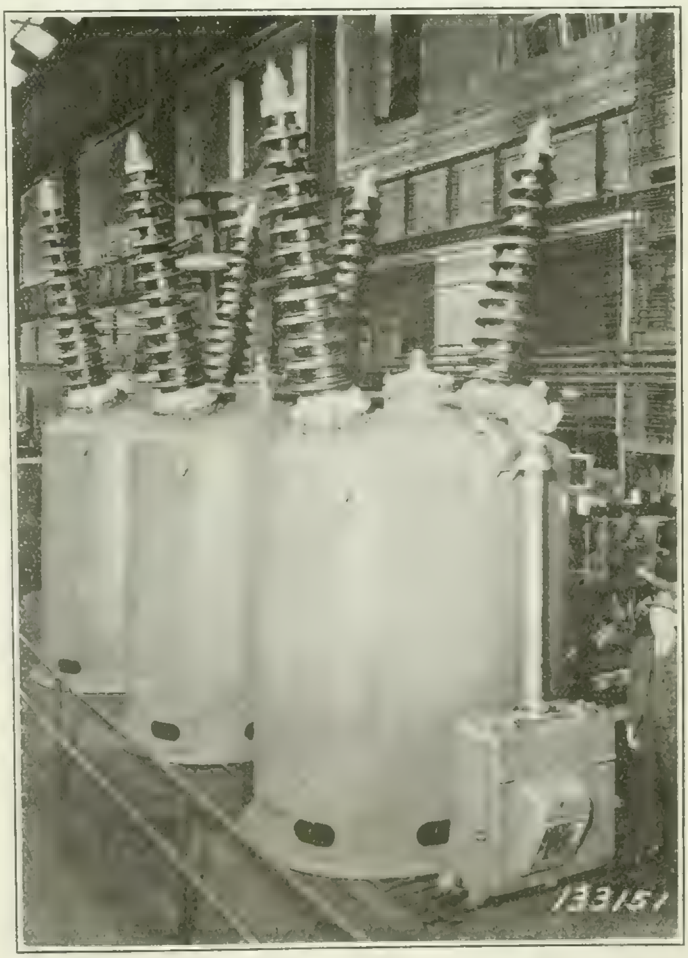


Figure 7. 220,000-Volt Circuit Breaker.

vented by using specially designed machines. A 30,000 to 35,000 kv. a., unit can be built that would handle this case and would have only a slight increase in cost over a normal design of possibly 10 or 15%. This special machine should have a wide range of excitation, while may fall even below the residual voltage of the exciter. To meet this condition a special broad range regulator should be used which can be of the combined vibrating and rheostatic motor-operated face plate types, the vibrating regulator taking care of the fine adjustments and the rheostatic regulator cutting resistance into the field circuit in such steps that the combined regulation will be continuous over the necessary range. By using a high speed motor-operated face plate this regulator fills the requirements.

In order to prevent voltage on the transmission line from rising above normal value, the generator voltage for the 200 mile line considered must be reduced to approximately 90% of normal in case the receiving end of the line becomes open. This can either be taken care of by hand or automatically. The automatic arrangement can be accomplished by a device that will lower the voltage when the charging kv. a., at no load exceeds a predetermined value.

As stated before a 220 kv., system should have a solidly grounded neutral. This will permit the usse of differential and ground current relays for the proper selection and isolation of a line in trouble without interruption of service.

A necessary and important device on a high voltage transmission system is the oil circuit breaker. The amount of energy concentrated on a 220 kv., system is bound to be large from the economics of the problem. The circuit breaker must therefore be of substantial construction and be capable of interrupting large amounts of power, possibly 750,000 to 1, 500,000 arc kv. a., for the larger systems. The Westinghouse Electric and Manufacturing Company have built six oil circuit breakers which will control the new 220 kv., lines from the Pit River development of the Pacific Gas and Electric Company. These breakers are in elliptically shaped tanks and have quick break arcing contacts. One of the breakers is shown in Figure 7. Recently the Westinghouse Electric and Manufacturing Company have received an order from the Southern California Edison Company for twenty-two oil circuit breakers which will go in cylindrical tanks and will also have quick break arcing contacts. These breakers are also for 220 kv., service and will be used for controlling their principal lines after the change over of the system from 150 kv., to 220 kv., has been made.

The chief abnormal voltage stress on a transmission system is between lines and ground. Whether these stresses on 220 kv., systems are serious or not and whether means for relieving them are advisable, such as the use of ground wires and arresters, have been given considerable discussion. Opinions on this subject differ. One aspect of the ground wire as applied to solidly grounded neutral systems so far has received little or no comments, that is, its stabilizing effect of the neutral along the line. In effect, the ground wire constitutes the fourth wire of a four-wire, three-phase system and as such should be tied to the station grounds at both ends of the line. The ground wire will then not only serve to hold each tower

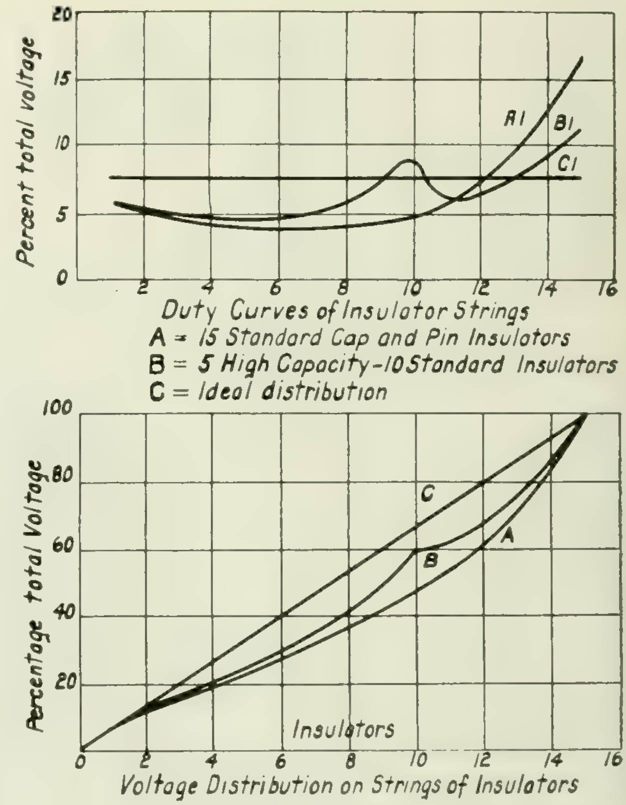


Figure 8

at ground potential, which otherwise may not be at ground potential in case of an insulator flashover due to poor ground connection of the tower, but will also give more definite relay action by reducing the ground resistance. The ground wire effectively reduces voltages caused by lightning 20 to 40%, depending upon its relative spacing to lines and ground. Such a reduction is appreciable when applied to voltages of the order of those required to flash over the insulation of 220 kv., lines and probably would bring induced voltages down to such values that the line insulators would withstand them for the short time that they exist. The overhead ground wire produces an additional load on the towers and may be a source of considerable trouble from breaks which may be out of all proportion to its benefits. It is interesting to note that for this reason ground wires were not recommended for 220 kv., in the super-power survey. Neither were lightning arresters recommended. It would seem that much of the objection to ground wires could be overcome by stringing them below the power lines without materially destroying their electrical advantages. The two 220 kv., transmission systems, now being built in California, will be provided with ground wires but no lightning arresters will be used so far as is known at present. In regard to the advisability of installing lightning arresters on 220 kv., lines only future experience will dictate. The most serious drawback at present seems to be their high cost.

Since reliability will be of great importance for the large amounts of power involved in 220 kv., systems,

the switching arrangements at both substations and power stations may be quite elaborate. An extensive use of disconnecting switches in the layout may lead to a material reduction in the number of oil circuit breakers required, especially with a double bus layout. Two general types of disconnects have been proposed for 220 kv., service. One consisting of a three pillar type where the central pillar rotates or carries a blade which engages both stationary pillars and thus gives a double break. The other consists of two stationary pillars carrying a knife switch opened by a toggle arrangement which is controlled by the rotation of a third pillar, thus giving a single break. These switches can be operated in gangs of three and permit of quite flexible arrangements in the station layout.

The high voltage equipment for 220 kv., requires considerable space both on account of its size and the large insulating distances required and for this reason should be installed out of doors.

The importance of the line insulators cannot be over emphasized, since the question of reliability and continuity of service hinges on them. Since the cost of insulators is a very small fraction of the total cost of the installation, it would appear worth while to increase the investment on line insulation, provided that greater reliability is obtained thereby. The line insulation must consist, at the present state of the art, of porcelain insulators in series. When insulators are placed in series in a string the voltage does not distribute uniformly over them. The insulator units near the line take more than their share of the voltage. In Figure 8 are given typical curves showing voltage distribution and voltage duty respectively of two strings of fifteen insulators each for dry conditions. In this figure, curve A is for fifteen standard cap and pin insulators with standard arcing horns. Curve B is for a mixed string consisting of five high internal capacity units next to the line and ten standard cap and pin units. Curve C is what would be obtained with ideal distribution of voltage. The last or fifteenth insulator for the uniform string takes 17% of the voltage: using five high capacity units next to the line reduces the voltage on the fifteenth insulator to 11-½% of full voltage. An ideal string would have 6-2/3% on the line unit. In the past a great deal of stress has been laid on good distribution over the string and little attention has been given to the fact that there are many conditions of operations on a string of insulators in which outside conditions are the largest factors in determining voltage distribution. Thus, the presence of alkali dust on the surface of the insulator does not affect the distribution to any great extend when dry, but under rain the dust becomes conducting and the form of the distribution not only changes but some units in the string may be completely bridged electrically and throw considerably higher voltage on the remaining units. Even under dry conditions the advantages due to grading of units are questionable. Although it decreases the stress on the line unit, it causes corona formation where the charges in insulators occur and at times makes the arc of the flashover cascade along the string. A more satisfactory way of relieving the end insulators of their high voltages is the use of guard rings. They not only improve the voltage distribution but help to keep arcs away from the insulator.

The Iron Ore Mines of Bell Island, Newfoundland

Historical Sketch, Description of Equipment and Details of Operation.

Sydney C. Mifflen, B. Sc., A.M.E.I.C.

Paper read before the Cape Breton Branch, The Engineering Institute of Canada, March 9th, 1922.

Bell island must of necessity be of more than ordinary interest to the Cape Breton, and especially, the Sydney, engineer because of the fact that the manufacture of its product, iron ore, is carried on at the steel plants of The Sydneys and New Glasgow. This description will deal more particularly with the operations of the Dominion Iron and Steel Company on Bell island than with those of the Nova Scotia Steel and Coal Company, because the writer, during his residence there, was employed by the former company and is consequently more familiar with their methods and equipment.

Reference to a map of Newfoundland will show Bell island to be situated more or less centrally on the south side of Conception bay, about two and one-half miles from the main-land. It is distant from St. Johns, the capital of Newfoundland, a two-hour journey by car and ferry, and from Sydney some three hundred and eighty miles by sea. As is well known, its feature of interest lies in the mining of the deposit of iron ore occurring on it and in its neighborhood.

The island is some six miles long by two and one half miles wide. On it are five small towns connected by some twenty miles of fairly good roads and having a combined population of six thousand, not including some twelve hundred transient labourers who come from various parts of the country for a longer or shorter period of work at the mines. Two-thirds of its residents are directly dependent on the mines as a means of gaining a livelihood while the remainder, engaged in business, farming, fishing, etc., are indirectly so. Its public buildings, churches, halls, schools, etc., are such that any mining community might be justly proud to have.

Physiographically, the island is an undulating plateau rising sheer out of the sea to a mean elevation of some 220 feet. Indeed, so steep are its sides, about 10° to 15° from the vertical, that before the coming of the mining companies a landing could be made at only two points; Lance cove and The Beach. An inclined tramway now operates at the latter place for the convenience of travellers and the handling of freight.

History

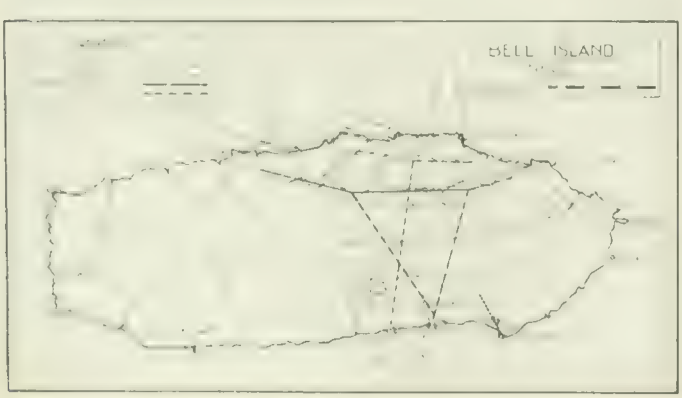
The earliest known mention of the ore fields of Bell island was made in 1842 by an English geological surveyor named Jukes. It was, however, wrongly designated by him as being bands of bright red "sandstone"; one of which, he noted, was eight feet thick.

Just who was the first to classify the deposit as iron ore is not definitely known. The fishermen of the island had been in the habit of using it for ballasting their boats and making primitive anchors by enclosing blocks of it in wooden frames. Its use as such was due to its comparatively great weight and compactibility. Tradition has it that it was from ballast being discharged at St. Johns that it first was recognized as iron ore.

In the Summer of 1893, R. E. Chambers, M.E.I.C., then mining engineer of the New Glasgow Iron Coal and Railway Company, but, today, truly, of Bell island fame, made an examination of the property and, acting on his report, the Hon. B. F. Pearson of Halifax and others secured an option on it. This option changed hands several times within the ensuing year, eventually being taken up by the New Glasgow Iron Coal and Railway Company, already mentioned. Mr. Chambers then made a second visit to the island, this time accompanied by Messrs. Graham Fraser, the principal, and Thos. Cantley, an official, of his company. After a more or less thorough examination of the deposits they, on behalf of their company, acquired the property. In 1895 this company underwent reorganization, emerging as the Nova Scotia Steel Company, (later as the Nova Scotia Steel and Coal Company), and in the same year development work was commenced on the island under the capable management of Mr. Chambers.

On Christmas Day of that year, the first cargo of ore, some 2,600 tons, was shipped from Wabana. Since that date an aggregate of over 19,000,000 tons has been mined and shipped, of which 13,000,000 tons have come to Cape Breton, the remainder being sold in European and United States markets.

Coincident with the acquisition of the property by the Nova Scotia Steel Company, the Dominion Coal Company through its president, H. M. Whitney, became keenly interested and obtained from the "Scotia" company an option on part of the property. At this period of its history the Coal Company met with some difficulties and the option was allowed to lapse. The interest felt by Mr. Whitney survived, however, with the result that in 1899 he formed the Dominion Iron and Steel Company and purchased a considerable area from Scotia.



As is well known, within the past year both the Dominion and Scotia companies have, with others, been merged to form the British Empire Steel Corporation, which now controls Bell island and the steel industry of eastern Canada.

Such is a short history of the ore deposits of Bell island and of the companies which brought it to its present stage of development; with what great results, beneficial to Newfoundland and Nova Scotia alike, it would indeed be hard to estimate.

Extent and Ownership

Five distinct seams of ore outcrop on the island. Of these, the three uppermost only are known to be of workable thickness in the area already proven. They are known as the "Upper", the "Scotia" and the "Dominion" or "Lower" beds; the locations of their outcrops being shown on the accompanying map.

The property is held in Fee Simple from the Crown, the title being vested in the constituent companies of the British Empire Steel Corporation. The land areas comprise some three and one-half square miles and the submarine areas eighty-five square miles.

Under the sale of 1899, the Dominion Iron and Steel Company became owners of the "Dominion" bed on Bell island and part of the "Upper", the Scotia company retaining the entire land area of the "Scotia" bed and the remainder of the "Upper". A submarine block adjacent to the north side of the island, extending some three miles east and west from Gull island to Ochre cove by a mile in depth, also became part of the holdings of the Dominion Iron and Steel Company. Seawards from this, the Nova Scotia Steel and Coal Company, held an area of slightly over eighty square miles; their northern boundary being a small block of one square mile owned by the Dominion Iron and Steel Company. Different from the land holdings, where each company owned individual seams, (or parts thereof), in the same area, in those which are submarine each company owns all seams within its boundaries.

As to the extent of the ore fields, and the amount of ore present, it is almost impossible to predict. Calculations based on geological and structural inferences tend to indicate that the total tonnage present will run over the billion mark. What part of this will be economically available will depend on conditions and circumstances impossible to foretell.

Geology

More or less exhaustive studies by several geologists of note have shown that the ore beds are of primary sedimentary origin, deposited on the bed of a marine sea throughout the upper one thousand feet of a series of sandstones and shales laid down in the Ordovician Period. The beds dip in a general northerly direction at from 8° to 10°.

A vertical section compiled from a diamond drill boring near the intersection of the Scotia tramway

and Dominion bed outcrop, shows the general stratigraphy of the fields. The upper bed is the highest and has a workable thickness of from five to eight feet. About fifty-five feet below it, is the Scotia bed; the intervening strata being sandstone with shale partings with pebble bands of hematite adjacent to each main bed. This bed shows a disconformity inasmuch as it is distinctly cross-bedded. Its thickness varies from seven to nine feet. Small local concentrations of galena occur which are regarded as a peculiarity, as is also the upper six inches of the bed, which, different from the prevailing "red" of the other ore, is of a distinct greyish texture, the colour being sharply defined.

Passing down the section through sandstone, with shale partings, and a heavy deposit of shale, the Dominion bed is met some two hundred and forty feet below the Scotia. The thickness of this seam runs from eight to twenty feet in general but in submarine workings a thickness of thirty-three feet has been met. Just overlying this bed are three bands of oolitic iron pyrites ranging in thickness from an inch to over a foot.

Below the Dominion bed is a series of sandstone and shale with numerous ferruginous partings—the two other seams mentioned being some three hundred feet and seven hundred feet respectively below the Dominion. Throughout the whole, fossils and fauna are numerous and rippel marks can easily be seen.

The surface of a fresh fracture of the ore presents a reddish grey colour which weathers to a reddish brown. There are two principal iron bearing minerals; oolitic hematite and chamosite. The former carries iron as a ferric oxide and the latter is an aluminous ferrous silicate. A third mineral, siderite, a ferrous carbonate, is also locally of importance as the iron bearing constituent of the ore but it is not persistent throughout the beds.

Microscopically, it is seen that the ore is composed of small spherical concretions, varying in diameter from one-tenth to one-half a millimetre. These are formed of concentric layers of hematite and chamosite around a nucleus which is occasionally a piece of shell or a grain of mineral, the interstices being filled very often by siderite in a crystalline form.

To anyone interested in a detailed study of the geology of this deposit, the writer would recommend Dr. A. O. Hayes'work entitled, "Wabana Iron Ore of Newfoundland". He wishes, also, to acknowledge his indebtedness to this work for much of the information in the foregoing.

Analysis

The Wabana ore beds are of a higher grade in iron than most other sedimentary ores of like origin. The following actual analysis can be taken as typical:—

Iron	52.35%
Silica	13.20%
Sulphur	0.04%
Phosphorous	0.85%
Alumina	4.20%
Lime	2.80%
Magnesia	0.68%
Manganese	0.43%
Moisture	1.75%

General Surface Layout

Reference to the accompanying map will show the general layout of the island. The Dominion bed outcrops for a distance of three and one half miles, from Gull island to Ochre cove. At more or less regular intervals along it are located Nos. 1, 2, 3, 4, and 5. of the Dominion mines. No. 1 is now worked out. It was entirely on land in the eastermost "wing" or "overhang" of the bed, before it became submarine. No. 2 has been the great producer and is developed to a greater extent than any of the others. It is now submarine, the total length of the main slope being about 5,400 feet. No. 3 is located more or less centrally. West of it is No. 4, which is of comparatively recent development but which is today producing a very high grade of ore. Its main deeps have not yet entered submarine areas. Located similarly to No. 1, but in the western "wing" of the seam, is No. 5. This slope has not been working of recent years and comparatively little ore has been mined therefrom. In the Scotia seam are two mines; Scotia No. 1, which is now finished, and Dominion No. 6, which was formerly Scotia No. 2.

As before mentioned, each company owned individual seams on land, but all seams in submarine areas. To tap their submarine areas, the Scotia company had first to pass through those of the Dominion company. An agreement was made between the two companies to this effect; the Scotia company undertaking to drive a new slope underneath the Dominion bed, and upon completion of this to transfer their portion of No. 2 slope on the land areas to the Dominion company. Through this arrangement Scotia could still produce while driving the new slope, (mostly through rock), and the Dominion company would gain its submarine areas in Scotia bed without cost of driving a slope.

Scotia No. 2 was therefore continued, entering the Dominion submarine areas in 1906. Work on the proposed tunnels under Dominion bed was commenced in 1913, two parallel slopes being driven through rock, and finished four years later. This is now the Scotia No. 3 slope, or as it is locally known, Scotia submarine. It was driven both ways; i.e., backwards from the submarine workings and also from the surface. The total length is 2¼ miles and the meeting was of remarkable accuracy; the divergence of centre lines being only 1¼ inches. The average section is 8 feet x 13 feet 6 inches. For a certain distance the dip of the slope was increased to 30° so as to cut the Dominion bed from which Scotia is now mining.

Running roughly parallel to the Dominion outcrop is a tramway by which the ore is collected from the mines to two yards; known locally as the east and west "bottoms". From these points, converging main line tramways run to the Dominion pier, thus forming a triangle. A similar layout of tramways was operated by the Scotia company; a collecting track parallelling their outcrop but only one main line running from a central yard to their pier. All tramway is double tracked, two foot gauge and is operated by endless haulage cable.

At various points near the mines were located machine electric and car repair shops, forges, smaller steam plants and compressors. The Scotia main power plant is situated

at their pier. The east power plant of the Dominion company is at the eastern corner of the triangle of track. Their central station; the new plant to which reference will be made later; is at their pier. The piers of both companies are located on the south side of the island.

Methods of Mining

In the early days of mining on Bell island, the outcrops of the various seams were stripped of the overlying soil and the ore then shot and loaded into cars by hand or steam shovel. Very little of this surface mining is now done, although there is still in reserve some two million tons which can be taken out in this manner but, of course, the stripping will be heavier as the seam makes cover.

The method of mining today is a modified form of the room and pillar system. Slopes are driven through the seams following the direction of full dip and from these slopes levels, alternating on either side, are driven at intervals of fifty feet on land and one hundred feet in submarine workings. Following the usual practice, these levels are inclined uphill to the slopes so as to give a grade of 1 to 1½ per cent in favour of the loaded cars coming out of the levels. Crosscuts and headways, driven parallel to the main slopes divide the area into rooms and pillars. Under this system it is estimated that in land workings 55 per cent, and in submarine 60 per cent, of the ore is taken out, before any attempt is made to "draw" the pillars.

All the mines are entirely free from gas of any kind. No mechanical ventilating plant has yet been required to supply air to the Dominion mines. The static head is controlled by means of stoppings, etc., so that the natural draft through the slope and an air shaft is all that is necessary, but a point will soon be reached where the force required to overcome the rubbing friction will be greater than the static force and mechanical power will be necessary. The Scotia submarine has a ventilation plant consisting of one four-foot and two three-foot Sturtevant fans, motor driven. Fresh air is led to the working faces in ducts and allowed to return through the main slope. The mines are also remarkably free from water, the usual practice being to collect the water in sumps during the day and to pump for three or four hours during the night. The entire pumping plant including relays, of Dominion No. 2, the largest mine, has a capacity in the neighborhood of 800 g.p.m. In Scotia submarine, the pumps work continuously but even this mine does not make a great quantity of water.

The ore has a very distinct cleavage from the rock and throughout all the mines the hanging wall is of such good character that very rarely indeed is any timbering or support of any kind needed. It is always shot from the solid, and breaks up readily into small briquettes, the lines of cleavage being parallel to the plane of embedment and the principal fault systems. It has been found that one pound of dynamite displaces two or three tons of ore. All drilling is done by day. The holes are loaded immediately the men leave the mines and the shooting is usually finished before midnight.

As to the equipment of the mines, it has been thought best to describe that of one mine as being typical of the whole and for this purpose Dominion No. 2 has been chosen. The main slope is double tracked with sixty-pound rail of two-foot gauge, lighter rails being used in the levels. The drills used are air driven Sullivan hammer drills taking 1¾-inch cross bits. All cars, both surface and underground, are steel and of standard size, the box being five feet by three feet, by two feet, which will hold 1.7 ton of ore. The ore is loaded into the cars by hand or mechanical shovels. A pair of men fill from thirty to forty cars per ten hour day, though a record of sixty-two has been made. The mechanical loaders in No. 2 are two Myers Whaley motor driven shovels. These each load upwards of one hundred and fifty cars daily.

This shovel is different from the ordinary type inasmuch as the bucket or dipper is mounted on a revolving crank instead of a boom. Very little headroom, (about 4 feet 6 inches), is required. It is operated by one man, the idea involved being: The entire machine moves ahead and plunges the dipper into the ore and as it is filled, backs out. The revolving crank brings the bucket to an upright position and throws its charge into a small hopper, from which it feeds to a conveyor belt and falls from this to the waiting cars. The operator has control of each separate movement but, when the shovel is working, all take place concurrently. Power is supplied through cone friction clutches and chain drives from a 20-h.p., d.c., motor.

The cars, as they are loaded, are taken from the working places by horses or small electrically operated 30-h.p., d.c., hoists to head and tail rope level haulages by which they are assembled at the landings. They are here coupled in seven- to ten-car trips and hoisted up the main slope to the deckhead.

The main hoist is a Vulcan, 7-foot diameter drum, driven by a General Electric a.c., variable speed, slip ring type, 3-phase, 500-h.p., motor, taking 485 amps., at 550 volts, and operating up to 442 r.p.m., with full load. It is operated from a master controller through contactor panels. The hoist is fitted with both hand and air operated brakes and with gears in the ratio of 31 to 242, and gives a cable speed of 1,250 feet per minute.

At the deckhead the cable is disconnected from the loaded trip and connected to a waiting trip of "empties", which immediately start down the mine. The loaded cars are then passed singly through end-dump tipples, over a spring switch to a kick-back and thence to the empty track. From the tipple the ore may pass over a belt from which a great part of the rock is picked out or it may go directly to a No. 8 gates crusher, driven by a 90-h.p., General Electric motor. It is fed from the crusher to an inclined belt, 36 inches wide at about 35°, from where the remainder of the rock is picked out. This belt is driven by a Northern Electric d.c., motor of 35 h.p., geared to the head rollers to give it a velocity of about 80 feet per minute. The picking belt discharges the ore into a hopper large enough to take one hundred tons more or less, and from here it is loaded through chutes into the cars to be shipped to the pier directly in summer, or into a side dump seven-ton car to be hoisted to the stock pile in the Winter season. The stock hoist is a Flory, operated by a 230-h.p., Harland d.c., motor. During the shipping season a No. 60 Marion steam shovel operates at the stock pile to load the ore into cars for transportation to the pier.

On the tramways the cars are gripped singly to the haulage cable. Arriving at the pier, they pass through tipples similar to those in the deckheads and discharge, reaching the return track by a run around or through kick-backs as they may be routed. These tipples are located around the edges of a storage pocket but from two of them the ore may be led to an inclined belt placed to discharge from a height over the centre of the pocket so as to distribute the ore evenly. There is also a crusher at the pier through which may be diverted all ore from surface workings.

The storage pocket is an excavation in the rock at the top of the cliff. Its capacity is 23,000 tons, though it has been extended on the north end to give a total capacity approaching 40,000 tons. This latter half is not yet in use. Underneath this pocket is a tunnel, and at intervals, are chutes from the bins so that the ore may be loaded to a horizontal bucket conveyor running through the tunnel and over a trestle to a tower at the pier head, dumping via an open chute directly to the hold of a steamer. This conveyor travels at about 100 feet per minute and can handle over 2000 tons per hour. In fact, 7,000 ton boats have been loaded in three hours; the average time being about three hours and twenty minutes, including time required to shift hatches. On the east and west sides of the tower are derrick booms to facilitate the discharging of freight.

Access can be had to the pier only by an inclined two-car, balanced, skipway with a grade of 43 per cent and over this all incoming freight must be hoisted.

As for Scotia, they mine in practically the same manner but collect the ore at a central pocket in the mine and hoist it to the surface in single twenty-ton cars. The system is balanced, an empty car going down while the load is coming up. They hoist through a distance of slightly over two miles in four minutes and a trip in one of those cars is quite an experience. "Rakes", or passenger cars run at morning and night to take the miners to and from work. They have no tipple in the deckhead, the cars being of the bottom dump type. Three different types of mechanical loaders are used, the Myers Whaley as described above, the Thew, and the Armstrong. The operations on the surface, the system of transportation to the pier and the handling at the pier, are similar to those of the Dominion company.

Dominion Power Plants

Within the past year an up-to-date central power plant has been put in operation. Previously the eastern power plant, referred to above, was the main station and in fact the only one generating electric power. There were also several smaller boiler plants located at or near the mines as required, but today electricity has replaced steam entirely and also air to a large extent and these latter have been dismantled.

In the eastern plant there are eight class A, Stirling boilers rated at 260 h.p., each. The main generating engines were a Bellis and Morcam 16½"x23"x33", and a Robb 17"x25"x14", driving directly connected Westinghouse d.c., generators of capacity 500 kw., and 300 kw., respectively. Current was generated initially at 550 volts but there was three wire connection to give 275 volts.

The main compressor plant was also in this station. It consisted of two Walker, cross compound, two-stage, compressors, each with a capacity of 3,500 cubic feet of free air per minute. The steam cylinders are 22 inches and 42 inches; air, 23½ inches and 38½ inches; stroke 48 inches compressing to 80 lbs. per sq. in. At various locations on the island are other compressors, viz., two Norwalks, three Rands and a Nordberg with a total capacity of 8,000 cubic feet per minute. All engines in the east plant were run condensing.

Situated on top of the cliff at the pier is another power plant with three similar Stirling boilers operating a small compressor, a 130-kw., d.c., generator, the skipway hoist, and the main haulage engine. This latter is a Robb engine, tandem compound, Corliss valve, 20"x28"x36", of 250 h.p., engaging through friction clutches to grooved drums around which the cables pass.

Central Power Station

As development work in the mines increased and a greater output was called for, it was seen that an increase in power was also necessary. Further, the advisability of having one central generating station was recognized. Fuel was an expensive item due to the long sea voyage from Sydney and hoisting to the surface and distributing it over the tramways to the various boiler plants made in considerably more so. At the same time, the pier, which had served for both loading and discharging ships, was rapidly approaching a state of more or less continual congestion and it was realized that an extension to it would have to be made.

These and other considerations led to the decision to construct a turbo-electric power station at tidewater and to build around it a pier sufficiently large to store a season's supply of coal which would be discharged directly upon it. Designs were accordingly prepared by the Sydney office under the direction of G. D. Macdougall, M.E.I.C., followed by K. H. Marsh, M.E.I.C., the writer being the field engineer on erection. The type of building decided upon was concrete foundations, steel frame, roof trusses and floor beams, brick curtain walls

New Central Power Station, and New Pier nearing completion.

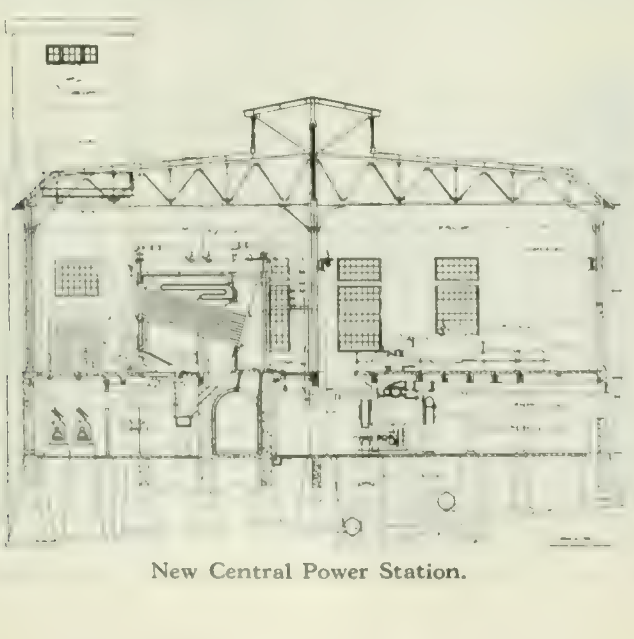
carried on basement wall of concrete, reinforced concrete floors, and wooden roof with tar and gravel waterproofing.

Soundings taken to the east of and adjacent to, the existing pier showed that a mean depth of thirty-two feet of water was available about two hundred and thirty feet from the shore line. Here a breast work was built in 1917, enclosing an area of some four hundred feet frontage by two hundred and thirty feet in depth. This was filled with rock brought from the mines and blasted from the overhanging cliffs.

The location chosen for the power plant was immediately at the cliff side, roughly on the north and south centre lines of the enclosure. The dimensions of the plant on centre lines of columns were 82 feet east and west by 101 feet 11 inches north and south. It was found that eighteen feet of water at the south-east corner was the extreme depth to be contended with in placing the foundations, and that barely twelve inches of silt and mud covered good bed rock.

A cofferdam of two 2-inch plank walls spaced twenty-four inches apart was constructed around the site, some ten feet being left as clearance between the dam and the foundations. Very little dependence against pressure could be put in the penetration of plank as it was so slight but a system of "figure 4" and rectangular bracing was employed, the latter to act as stiffeners from side to side, and front to cliff. The space between the plank walls was filled with a pug and a dump of the same made on the outside of the wall so that the top width of the dam was about eight feet sloping naturally to a varying width depending on depth of water. The pumping plant consisted of two centrifugals of 2,000 g.p.m., and 400 g.p.m., capacity, respectively, and four Camerons with a combined throw approaching 1,000 g.p.m.

All columns were supported by battered piers of average top dimensions, 2 feet 6 inches by 3 feet 6 inches. These latter were connected by arched curtain walls of mass concrete, 25 inches in thickness by usually 60 inches in depth. The whole was poured monolithically. Foundations for boilers and generators were of the same general type. All foundations were brought to elevation 10.75 above low water.



New Central Power Station.

The stack was located some forty feet to the east of the building, and connected thereto by an arched reinforced concrete breeching. At this point a considerable depth of clay with boulders was found on the bed rock. Creosoted hard pine piles were driven at two-foot centres and over these a heavy mat of concrete, some 40 feet square, was laid to take the actual stack foundation. This latter was 24 feet 6 inches square at the base, tapering to an octagonal section of 20 feet diameter at elevation 29.25. The stack is steel, self supporting. and was erected by the Maritime Bridge Company under separate contract. It is 9 feet in diameter and 187 feet in height., i.e,. about 216 above mean low water, or some 20 feet above the top of the cliff at this particular point.

The steel columns,which ranged from single 10 inch H's to built-up latticed columns of 12 inches by 30 inches outside section of H's and channels, weighing up to four tons, were all erected by means of timber A-frames and tripods. The placing of the roof trusses, girders and beams occasioned no difficulty as they were not of great weight. After the main steel work was in position, the basement wall, of 21 inches of concrete, was poured to elevation 25.75 and brickwork proceeded with. The floors, boiler flue, column casings, etc., were poured later as the interior steel and forms were erected. All steel is encased in concrete. To the west of the building, foundations were placed for an additional battery of boilers and for an L extension to the building, to provide for future installment. The total yardage of concrete in the entire structure was about 3,300.

The concreting plant consisted of a half yard Ransome, motor driven, mixer. The materials were hoisted up an incline to a platform, there proportioned and fed through a chute to the mixer. Wheelbarrows were used to distribute the concrete. A fair percentage of good clean "plums" was added after the concrete had been poured into the forms. Care was taken, by "spading", to see that these were well embedded and kept from the surfaces. Concreting and form-building went on concurrently once the latter was far enough advanced. Rough one-inch boards, and two by fours were used in form work and, where necessary, heavier stock was used for bracing.

A central wall east and west divides the building into two halves, the turbine and the boiler rooms. The general arrangement of machinery can be seen from the accompanying section.

Boiler Plant

There are two batteries of Babcock and Wilcox boilers, of 4,780 square feet of heating surface per boiler. Steam is generated at 175 lbs., gauge pressure with 150°F. of superheat.

Fuel is fed by Taylor stokers with extension grates and power operated dumping mechanism. The stokers are operated by Troy reciprocating, 5"x7" engines. Forced draft is supplied by two Buffalo fans located in the basement. These are capable of delivering 30,000. cu. ft of free air per minute at 5½ inches static pressure and are operated by direct connected single stage Terry turbines of 58 h.p.,

at 175 lbs., working pressure and 1,840 r.p.m. The Stoker engines and fans are interconnected by automatic control regulators so that their rates of operation are mutually dependent and in accord with the demand for steam.

Specifications of the boiler plant call for the following efficiencies:—Combined boiler and furnace, not less than 75%; furnace, not less than 98%; and a gas analysis shall show not less than 13½% carbon dioxide nor more than 0.1% carbon monoxide.

The boiler feed pumps are two Fairbanks Morse reciprocating, 12″x7″x12″, and are so piped that if necessary they can be used as fire pumps. Feed water is heated to 210°F. in a Cochrane V-notch recording heater of a maximum capacity of 100,000 lbs., per hour.

Generating Plant

The generating units are two direct connected turbo-generators, supplied by the General Electric Company. Dealing with one unit, the prime mover is a three-stage Curtis steam turbine, 160 lbs., steam pressure at the throttle, speed 3,600 r.p.m., exhausting to Wheeler surface condenser of 2,200 sq. ft., condensing surface, designed to maintain 1½-inch absolute vacuum. Sea water, led in ducts from the pier side to a sump, is used as cooling water and is circulated by a 10-inch centrifugal pump of 2,330 g.p.m., capacity against an 18-foot head, at a speed of about 830 r.p.m. This pump is operated, through flexible couplings and Poole turbo reducing gears, by a Curtis steam turbine, single-stage, non-condensing, taking steam at 160 lbs., pressure, speed 3,600 r.p.m., rating at 25 h.p. The condensate is delivered to the feed water heater by a 2-inch centrifugal pump direct connected to a Terry steam turbine, 130 lbs., pressure, 2,500 r.p.m., 5 h.p. A 16-inch Multiplex Patent atmospheric exhaust relief valve is installed as a protection in case of loss of vacuum. Hand operated by-passing valves are also installed so that the turbine can be run non-condensing in emergency.

The alternators are of the three-phase, 60-cycle type, designed to generate 1,250 kw., at 2,300 volts, power factor 0.8, 3,600 r.p.m. Field excitation is provided by a 13-kw., 125-volt, d.c., generator mounted on an extension of the main shaft.

Bus bars from the generators lead underneath the floor and up, through oil switches, to the main busses which are supported by, and above, the switchboard frame work. This latter, with extensions, also carries the distributing busses.

The switchboard consists of two generator and exciter panels, arranged for parallel operation of generators; one transformer panel; one station service panel; one instrument panel; and two outgoing feeder panels. Current is transmitted over the lines at 6,600 volts from three step-up transformers each of 833 kv.a., normal capacity. The lightning arresters are of the aluminum cell, electrolytic type for indoor use on the 6,600-volt circuit. The turbine room is equipped with an overhead, hand operated, travelling crane of 20 tons capacity.

The transmission lines lead from the wall bushings to an insulator arm projecting from the cliff side and thence straight up to a steel tower on the top. From here pole lines follow the tramways to the east and west substations.

Operating outside the power station, over the area provided for the stocking of coal, is a Brown Hoisting and Machinery Company locomotive crane with a grab of 54 cu. ft., capacity from a 50-foot boom. This crane feeds the coal to a hopper, whence it passes through crushing rolls and, via a bucket elevator, to a 60-ton storage bin, descending to the stokers through 12-inch chutes.

Substations

The east substation is situated near No. 2 mine. It houses two banks of transformers, a motor-generator set and the Vulcan main hoist referred to above, together with the necessary operating equipment. The voltage is stepped down through 250-kv.a., transformers to 550 volts for connection to the Vulcan and through 500-kv.a., transformers to 2,200 volts to operate the motor-generator set.

The motor-generator set consists of a synchronous motor rated at 1,100 kv.a., at 2,200 volts with a 700 h.p., output, 0.5 power factor, 900 r.p.m., and a d.c., generator of capacity of 870 amps., at 575 volts, both General Electric machines.

At No. 4 mine are two substations. One consists of a bank of transformers stepping-down to 550 volts to operate a Vulcan hoist motor similar to that at No. 2. In the second the voltage is transformed to 220 volts for crusher and belt motors and to 2,200 to connect to a motor driven Canadian Ingersoll Rand air compressor. This compressor is two-stage, the cylinders being 20¼ inches and 32 inches diameter, stroke 24 inches, and compresses 3,200 cu. ft., of free air per minute to 80 lbs. per sq. in. The motor is synchronous, rated at 477 kv.a., power factor 1.0, speed 164 r.p.m.; or the equivalent of 596 h.p., output.

The thanks of the writer are due to H. B. Gillis, superintendent mines and quarries, British Empire Steel Corporation for permission to write this paper and also for his kindness in reviewing it.

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Professional Meetings 1922

Vancouver: June sixteenth and seventeenth.
Winnipeg: September fifth, sixth and seventh.

British Columbia Professional Meeting.

Further details are now available as to the programme of the B. C. Professional Meeting, which is to be held in Vancouver on Friday and Saturday June sixteenth and seventeenth and while the programme as given below is only provisional, it is expected that the final programme will differ only in additions to the present plans. Both the Victoria and Vancouver Branches are co-operating to make this first Professional Meeting on the Pacific Coast, one of particular interest and enjoyment to all those who are fortunate enough to be present.

Provisional Programme.

Friday, June 16th.

9.00 A.M. — Registration.
9.30 " — Address of Welcome.
10.00 " — Town Planning.
11.00 " — Irrigation.
12.30 P.M. — Luncheon at Hotel Vancouver.
2.30 " — Inspection Visit to Ballantyne Pier.
3.30 " — Engineering in B.C., Logging Industry.

Saturday, June 17th.

9.00 A.M. — Business Meeting.
Welfare
Policy
British Columbia Provincial Division
2.00 P.M. — Sightseeing Trip to Peace Arch.

Engineering Legislation In Ontario

The Ontario Professional Engineering Bill came before the House again on May 10th, and was discussed at some length. The majority of the members seemed to be in favour of it, but a few raised considerable objection to Clause 34. This, as presented to the House, read as follows:—

"34. Any person in the Province of Ontario who, not being registered as a member of the Association in the Province of Ontario, or licensed by the Association;

(a) Practises as a professional engineer;
(b) Usurps the function of a professional engineer
(c) Uses verbally or otherwise the title of professional engineer, or makes use of any addition to or abbreviation of such title, or of any words, name or designation that will lead to the belief that he is a professional engineer or a member of the association, or that he is a person specially qualified to practise in any branch of professional engineering;
(d) Advertises himself as a professional engineer in any way or by any means.
(e) Acts in such manner as to lead to the belief that he is authorized to fill the office of or to act as a professional engineer;

shall be liable upon summary conviction by any court of competent jurisdiction to a fine of not less than $100 nor more than $200 for the first offence, and to a fine not less than $200 nor more than $500 for any subsequent offence.

After various suggestions as to possible re-wording, the Bill was finally referred back to the Special Committee of the House which had previously considered it. This committee recently met, together with a delegation from the Advisory Conference committee and the Executive of the Toronto Branch, and after prolonged discussion it was arranged to report back the Bill with Clauses a and b deleted. It is generally thought that in the amended form it will be acceptable to the Legislature.

Professional engineers will feel disappointed that the House could not see its way clear to passing the Bill in its original form, but even as amended it will be a marked achievement. This applies not only to Ontario but to Canada as a whole, because the other Provincial Acts cannot

be of full value until the legislative chain be complete, and Ontario forms another link to that end.

Recent Honours and Degrees

The Institute extends its heartiest congratulation to the following members who have recently completed their courses at Queen's and McGill Universities and have qualified for the various degrees in Applied Science. The list of these members is long and is headed by the names of those receiving Honours followed in turn by the M.Sc., and B.Sc. With assurance that the peak of the present period of industrial depression is passed *The Institute* is prepared to render assistance to its younger members in every manner possible.

Queen's University

Honour Graduates

Jr.E.I.C.: D.J. Emrey, B.Sc., Kingston, Ont.
Students: R.J. Clench, B.Sc., Kingston, Ont.
H. R. Myers, B.Sc., Stratford, Ont.

Degree of B.Sc.

Juniors: J.A.H. Henderson, B.Sc., Ottawa, Ont.
G. S. Walker, B.Sc. Ottawa, Ont.
Students: J. P. Devenny, B.Sc., Renfrew, Ont.
D. G Geiger, B.Sc., Kingston, Ont.
W. Greenwood, B.Sc., New Liskeard, Ont.
C. E. Malone, B.Sc., Regina, Sask.
D. R. Roughton, B.Sc., Kingston, Ont.
J. B. Saunders, B.Sc., Kingston, Ont.
J. P. Young, B.Sc., Owen Sound, Ont.

McGill University

Honour Graduates with Degree of B.Sc.

Students: Percival Elliott Biggar, B.Sc.—British Association Medal; Undergraduates' Society's First Prize and the Crosby Steam Gauge, and Valve Co's Prize for Summer Essay; Honours in Mechanical Engineering.
Harold Rudolph Bissell, B.Sc.—Honours in Mining Engineering.
Charles Lennox Brooks, B.Sc.—Honours in Chemical Engineering.
George Henry Desbarats, B.Sc.—Departmental Prize for Summer Essay; Honours in Electrical Engineering.
Harold Louis Humes, B.Sc.—British Association Medal; Milton Hersey Prize for Summer Essay; Honours in Metallurgical Engineering.
William Aubrey Messenger, B.Sc.—Prize for Summer Essay.
Harold Edgar Mott, B.Sc.—British Association Medal; Honours in Electrical Engineering.

Degree of M.Sc.

A.M.E.I.C.: Geoffrey J. Dodd, M.Sc., Montreal, Que.
Jr.E.I.C.: Albert E. MacDonald, M.Sc., Halifax, N.S.
Students: James B. Brow, M.Sc., Charlottetown, P.E.I.
Charles L. Dewar, M.Sc., Ottawa, Ont.
Donald R. Harrison, M.Sc., Tamworth, Ont.
Charles U. Vessot, M.Sc., Ottawa, Ont.

Degree of B.Sc.

Jr.E.I.C.: David Whitney MacKeen, B.Sc., (Civ.), Halifax, N.S.
Harold Oswald Day Wilkins, B.Sc., (Me.), Norwood, Ont.
Students: Arthur Weston Ahern, B.Sc., (Chem. Eng.) Quebec, Que.
Lawrence Henry Armstrong, B.Sc., (El.), Montreal, Que.
Ross W. Bastable, B.Sc., (Me.), Lachine, Que.
Sidney Bonneville, B.Sc., (El.), Ottawa, Ont.
John Ross Bradfield, B.Sc., (Civ.), Morrisburg, Ont.
Edmund Vere Brown, B.Sc., (El.), Winnipeg, Man.
Cecil Edward Carson, B.Sc., (Chem. Eng.), Dorval, Que.
George Herbert Cartwright, B.Sc., Croydon, Surrey, Eng.
George Silas Clark, B.Sc., (Me.), Lachute, Que.
Charles A. O. Cousineau, B.Sc., (Civ.), Montreal, Que.
Robert Eric A. Crawford, B.Sc., (Me.), Montreal, Que.
Ross Newton Drummond, B.Sc., (Chem. Eng.), Montreal,
William James S. Evans, B.Sc., (Me.), Montreal, Que.
John Spencer Farquharson, B.Sc., (Chem. Eng.), Montreal, Que.
George Harold Fisk, B.Sc., (Civ.), Montreal, Que.
Robert Ford, B.Sc., (Me.), Ottawa, Ont.
Roy Holmes Foss, B.Sc., (Me.), Sherbrooke, Que.
Walter Stilson Gould, B.Sc., (Me.), London, Ont.
Ralph Glencoe Grant, B. Sc., (Chem. Eng.), Montreal, Que.
Israel T. I. Gurman, B.Sc., (Chem. Eng.), Montreal, Que.
Conway Hemsley D. Henderson, B.Sc., (Met.), Montreal, Que.
Everett Eric Holmes, B.Sc., (Me.), Westmount, Que.
George Elliott Kerr, B.Sc., (El.), Fernie, B.C.
John Mayer Loebel, B.Sc., (Chem. Eng.), Montreal, Que.
Louis Gustave Lorin, B.Sc., (Civ.), Montreal, Que.
William Raymond McClelland, B.Sc., (Met. Eng.), Halifax, N.S.
Stewart Lawrence MacDonald, B.Sc., (Mi.), Hamilton, Ont.
Donald Gordon Mackenzie, B.Sc., (Chem. Eng.), Montreal, Que.
Logan Seaforth McLennan, B.Sc., (Civ.), Vancouver, B.C.
Robert John Mitchell, B.Sc., (El.), Vancouver, B.C.
James Geoffrey Notman, B.Sc., (Mech. Eng.), Montreal, Que.
John Edmund Paddon, B.Sc., (El.), Montreal, Que.
Douglas E. Perriton, B.Sc., (Me.), Westmount, Que.
Richard Valentine Porritt, B.Sc., (Mi.), Cowichan Station, B.C.
Kenneth MacPherson Ramsay, B.Sc., (Me.), Quebec, Que.
Gordon Reed, B.Sc., (Civ.), Montreal, Que.
John Gordon Robertson, B.Sc., (Me.), Montreal, Que.
James Hargrave D. Ross, B.Sc., (Chem. Eng.), Montreal, Que.
Andrew Scott Rutherford, B.Sc., (Civ.), Westmount, Que.
Maynard James Spratt, B.Sc., (Civ.), Ottawa, Ont.
Lambert David Tatley, B.Sc., (Chem. Eng.), Westmount, Que.
Edward Plunket Taylor, B.Sc., (Me.), Ottawa, Ont.
Hartland Bates Wilder, B.Sc., (Civ.), Westmount, Que.
Selwyn Hamilton Wilson, B.Sc., (Me.), Ottawa, Ont.
Walter Richard Wonham, B.Sc., (El.), Westmount, Que.
Charles Desmond Woolward, B.Sc., (Civ.), Westmount, Que.

The similar list of Graduates of the University of Toronto will appear in the July issue of *The Journal*.

Invitation to A.I.E.E., Annual Convention.

The following very cordial invitation to all members of *The Engineering Institute of Canada* to attend the Thirty-eighth Annual Convention of the American Institute of Electrical Engineers, has been received at Headquarters:

"My dear Mr. Keith:—

This Institute is to hold its Annual Convention at the Clifton Hotel, Niagara Falls, Ontario, June 26-30, 1922, and at a meeting of our Board of Directors held this day, I was authorized to extend through you a cordial invitation to the membership of *The Engineering Institute of Canada* to attend our Annual Convention and to participate in the various technical sessions and other events.

I regret that I am unable to furnish a final programme at this date, but I am enclosing herewith proofs of an announcement that we expect to issue to our membership next week, and which may contain some information that will be of interest to you.

With best regards, I am,

Very truly yours,

Signed: F. L. HUTCHINSON,
Secretary."

While the final programme is not yet available, the Tentative Technical Program lists many very interesting papers, which are divided into the following classes:—

Class A: Four papers describing the Queenston Plant and its 45,000-kv. a. generators and transformers.

Class B: Three papers relative to the Standard of Rating of Class "B" Insulation, and Conventional Allowances for Generators.

Class C: Three papers relating to the Baltimore tests of Oil Circuit Breakers.

Class D: Six papers of the Symposium on Engineering Education.

Class E: Papers on a variety of subjects; ranging from mechanical engineering to pure physics.

Class F: A group of nine papers relating to Cable Insulation.

In Class A, are two papers to be presented by members of *The Engineering Institute of Canada;*

(1) The Queenston Plant, by F. A. Gaby, M.E.I.C., chief engineer, Hydro-Electric Power Commission of Ontario.

(2) Queenston Generators, 45,000 kv.a. Description of the Canadian General Electric Company's generator, 187½ revolutions per minute, vertical, 25-cycle, 12,000-volt, three-phase, by B. L. Barns, A.M.E.I.C., engineer, Canadian General Electric Co.

The Convention committee is composed of the following members, under whose direction the elaborate plans for the presentation of technical papers and the entertainment of those attending the convention have been prepared:

Chairman,—F. R. Ewart, M.E.I.C.,

Chairman, Meetings and Papers Committee, — E. E. F. Creighton;

Chairman, Sections Committee,— A. W. Berresford; H. G. Acres, M.E.I.C.; L. E. Imlay.; W. P. Dobson, M.E.I.C.; J. Allen Johnson.

Unveiling of Memorial Statue and Tablet.

To the memory of the men of the Canadian Pacific Railway who lost their lives in the Great War, and in honour of all those who served overseas, the company has erected a memorial statue and a bronze tablet at the Windsor Street station in Montreal. His excellency Lord Byng officiated at the dedication of the two memorials on the occasion of the unveiling on April 28th. The record of the company's employees during the war is one of which they might be justly proud; 11,340 men enlisted of whom 1,115 lost their lives in action or died of wounds, and 2,105 were wounded, while the decorations won include two Victoria Crosses, six Orders of the British Empire, seventeen D.S.O., three D.S.C., fifty-four M.C., forty-seven D.C.M., and one hundred and eighty Military Medals.

Memorial to the men of the C.P.R who lost their live in the war.

The Company's list of those who were killed in action includes two of the younger engineers of *The Institute*, John Henry Rosher, Jr.E.I.C., killed in action March 20th, 1915, and Lieut. Douglas M. Ewart, M.C., Jr.E.I.C. The late Mr. Rosher was born in London, England on June 12th, 1890 and received his education in Bedford, England. On coming to Canada in 1910, he was employed by the Canadian Pacific Railway Company, Irrigation Department, for four seasons on surveys and finally, as assistant engineer on location and construction of irrigation works at Bassano, Alta., which position he held at the time he enlisted. Mr. Rosher was admitted to *The Institute* as Student in 1911 and transferred to the grade of Junior on January 19th, 1915. The late Mr. Ewart was born at Ottawa, Ont., on February 8th, 1890; received his primary and high school education in Ottawa, and graduated with the degree of B.Sc. from McGill in 1910. He was appointed to the engineering staff on the Canadian Pacific Railway Company in 1910 and worked for three years near Ottawa as leveller, transitman, and assistant resident engineer, and was appointed in 1913 resident engineer for the company at West Toronto, Ont. Mr. Ewart was admitted to *The Institute* in 1909 as Student and transferred to Junior on August 18th, 1914.

OBITUARY

Harry Dean Bush, M.E.I.C.

In the death of Harry Dean Bush, M.E.I.C., on March 15th, 1922, at his home on Main Avenue in the city of Baltimore, the engineering profession has lost another of its most eminent members and profound regret is expressed on all side by his many friends, both within the profession and in the numerous spheres of social and business activities with which he was connected. Mr. Bush was born in Springfield, Massachusetts on April 2, 1857, and was descended, on both sides, from old New England families of colonial distinction.

He received his preparatory education in the elementary and high schools of his native city. Later he attended the Worcester Polytechnic Institute, whence he was graduated with honour, ranking second in his class and receiving the degree of Bachelor of Science. His special tastes were for science and mathematics. He was always a great reader and in the course of his life collected a large library of essays, romance, poetry and the drama.

Mr. Bush was a civil engineer of high standing and a business man of no mean ability. He entered upon the career of a civil engineer in the old R. F. Hawkins Bridge Works in Springfield and became, at the end of two years, bridge engineer for the Northern Pacific Railway Company, with headquarters at Portland, Oregon, After four years at Portland he was for one year assistant engineer in the office of George S. Morrison, New York City, and for three years superintendent of the bridge shops of the Dominion Bridge Company, Limited, of Montreal, Canada. After terminating his connection with the Dominion Bridge Company, Mr. Bush spent a year of travel and study in Europe and upon his return was again associated for two years with Mr. George S. Morrison of New York city, after which he went again to Portland, Oregon, where for three years he was engineer and superintendent for the contractors who constructed the Bull Run pipe line, twenty-four miles long, for the Portland city water works system, and the Steel gates for the Cascade locks, Columbia river, the largest ever built previous to the Panama canal.

Mr. Bush next became contractor for the pipe line for the water works system of New Bedford, Massachusetts, and in 1899, after an absence of ten years, returned to the Dominion Bridge Company as engineer in charge of the erection of bridges. In this capacity he had charge of the erection of the Royal Alexandra bridge across the Ottawa river at Ottawa, Ontario, and later presented a paper to the Canadian Society of Civil Engineers on the construction of this bridge, for which he was awarded the Gzowski medal, an annual prize given the writer of the paper or article of the highest merit on some phase of engineering.

In 1903 Mr. Bush came to Baltimore and became vice-president and manager of the Baltimore Bridge Company, then recently organized. It was through his untiring energy and devotion that this company soon acquired a well-deserved reputation of the highest standard, furnishing steel bridges and building for the Baltimore and Ohio and other railroads, the notable steel arch bridge over the spillway of the Croton dam for the New York City Aqueduct Commission, and much work for export, including all of the bridges in the Guatemala Railway system, bridges in Costa Rica, sugar mills in Cuba and several important contracts for the Isthmian Canal Commission. It was largely due to his work that the Baltimore Bridge Company was acquired by the Carnegie Steel Company about 1912, and as a result of this new connection the scope of the plant was greatly enlarged under his continued management.

In the Spring of 1911 a new industry was brought to Baltimore from Newark, New Jersey. This new concern was known as the Tube Bending and Polishing Machine Company and was backed financially by Miner C. Keith of New York, the president and owner of the Baltimore Bridge Company. Mr. Bush became president of this new company as well as of the compressed Copper Company, an organization subsidiary to it. The Tube Bending and Polishing Machine Company was later reorganized into the Baltimore Tube Company, Inc.

Mr. Bush was essentially a man's man and it has been said of him that he was pre-eminently a friend of men, especially young men. Sympathetic and kindly in his relations with men, he was never so happy as when enabled to render a good turn to one of his fellows. He was admitted to *The Engineering Institute of Canada*, then The Canadian Society of Civil Engineers, as Member on April 25 1901, and was a member of the American Society of Civil Engineers, the Engineers' and Whitehall clubs of New York city and the Baltimore Athletic Club.

Mr. Bush is survived by his wife, Francis Dent Bush.

PERSONALS

Stanley A. Neilson, Jr.E.I.C., has accepted a position with Walter J. Francis and Company, in Montreal.

D. Shaw, A.M.E.I.C., assistant engineer with the Canadian National Railways, has been transferred from Drumheller to the division engineer's office at Calgary.

Paul C. Kirkpatrick, A.M.E.I.C., who was previously located at Niagara Falls, Ont., is now with Fraser Brace, Limited, at Great Falls, Man.

B. B. Tucker, S.E.I.C., has returned to his home in England and is located at Kings Nympton, Chulmleigh, North Devon, England.

J. C. Gardner, A.M.E.I.C., who is a graduate of Toronto University of the class of '04, has recently been appointed to the position of road engineer for Welland county.

James A. McNicol, M.E.I.C., formerly resident engineer for the Canadian Pacific Railway at Winnipeg, has accepted a position with the Transportation Commission of Toronto.

P. J. Duff, A.M.E.I.C., of Philadelphia, Pa., is now a partner in the firm of Alkin and Duff Engineering Company, D5 Clive Building, Calcutta; mailing address, P.O. Box 2380, Calcutta, India.

W. R. Clarke, S.E.I.C., formerly engineer with the Nova Scotia Steel and Coal Company, is now with the Dominion Iron and Steel Company, Wabana, Newfoundland

James M. Begg, A.M.E.I.C., of Brandon, Man. is now in the Old Country, and communications addressed to "Greenbank", Cumnock, Ayrshire, Scotland, will reach him.

Sidney Harding, A.M.E.I.C., S.L.S., has recently opened an office for land surveying and general civil engineering in Punnichy, Saskatchewan. Mr. Harding previously carried on a similar practice in Regina.

H. L. Bucke, M.E.I.C., of the Niagara Peninsula Branch, has been appointed general superintendent in charge of the canal and river sections of the Queenston-Chipawa Power Development at Niagara Falls.

H. P. Borden, B.Sc., M.E.I.C., formerly of the Department of Railways and Canals, has opened an office for the purpose of carrying on a general consulting practice, specializing in bridges and structures, in steel and concrete, at 709 Hope Chambers, Ottawa, Ont.

W. G. Mitchell, B.Sc., M.E.I.C., until recently special technical representative of the Canadian Export Paper Company, Ltd., Montreal, has been appointed assistant to the president of Price Brothers and Company, Ltd., with headquarters at Kenogami, Que.

P. H. Mitchell, E.E., M.E.I.C., of the consulting engineering firm of C. H. and P. H. Mitchell of Toronto, has been appointed by Premier Drury to make an inventory of the materials and suplies used on the Chipawa power development.

Gabriel Henry, A.M.E.I.C., has been appointed superintendent of the Service of Maintenance and Improvement of Roads under the Ontario Provincial Roads Department, with which department Mr. Henry was formerly chief inspector of roads.

J. Rhind, S.E.I.C., and B. C. Rochester, S.E.I.C., have just completed their third year in electrical engineering at McGill University, and have taken out an agency for the Marconi Radio-Receiving sets with headquarters at 15 St. Mark Street, Montreal.

D. T. Main, M.E.I.C. who was for some time past located at Watervliet, New York, as vice-president of Bird Archer Company of New York, is now works inspector and sales engineer in charge of the Engineering Sales Department of the National Steel Car Corporation,Limited, in Hamilton, Ontario.

R. G. Ramsay, Jr.E.I.C., formerly assistant engineer to the resident engineer of the Department of Public Highways of Ontario, at Napanee, Ontario, has been appointed to the staff of the divisional engineer, Department of Public Highways of Ontario, Toronto-Montreal Division.

Lt.-Colonel H. F. Meurling, D.S.O., M.C., Croix de Guerre, of Vancouver, B.C., who has for many years been prominently connected with irrigation and reclamation projects in the west, has recently returned from England where he has spent the last fourteen months in connection with a land settlement project being considered by the syndicate of which Lt.-Col. Meurling is head.

H. A. Terreault, A.M.E.I.C., has been appointed director of public works for the city of Montreal. Mr. Terreault came to Montreal from Sorel, Que., where he was stationed in connection with Government work, to accept the position of superintendent of the municipal aqueduct department. His work in this capacity has earned him the recent promotion to the post corresponding to chief engineer of the city.

R. L. Hearn, A.M.E.I.C., of the Niagara Peninsula Branch, personal assistant to H. G. Acres, M.E.I.C., on the Queenston-Chipawa Power Development, has accepted an offer from the Washington Water Power Company to become their hydraulic engineer. He will leave for his headquarters at Spokane, Wash., in about a months time. The congratulations of the Branch and especially of those with whom Mr. Hearn has been associated on the staff of the Hydro-Electric Power Commission, are extended to him in his success.

George Hemmerick, A.M.E.I.C., of Conestogo, Ont. has recently completed the graduate engineers' course in economics at Queen's University. Mr. Hemmerick is a graduate of Queen's, in civil engineering, 1916, and prior to graduating was engaged on underground surveys at the Hollinger Gold Mines. Since 1916, he was first employed on D.L.S. work; then as resident engineer on construction of the Canadian Cordite Works at Nobel, Ontario; and more recently as resident engineer and attorney for E. G. M. Cape and Company, contractors on building construction at Montreal and La Tuque, Quebec.

H. S. Van Scoyoc, M.E.I.C., has recently been elected president of the Montreal Publicity Association by acclamation. Mr. Van Scoyoc is a graduate, in applied science, of the University of Pennsylvania 1907. Prior to coming to Canada he was on the city engineers' staff at Altoona, Pa. In July 1912 he was appointed inspecting engineer with the Canada Cement Company, with which company he is still associated. At present Mr. Van Scoyoc is consulting engineer to the Toronto-Hamilton Highway Commission and with the Canada Cement Company, Consulting Engineer Service and Promotional Departments.

Frank P. Vaughan, M.E.I.C., of St. John, N.B., was recently the recipient of the honorary degree of M.Sc., from the University of New Brunswick. Mr. Vaughan is widely known in connection with his electrical and scientific work. He was born in Liverpool, England in 1874 and was educated at Regent College, Southport, England. Since coming to America he has been continuously engaged on electrical engineering work first in British Columbia, and, in turn, in Nova Scotia, New Brunswick, Massachusetts and New York, returning to New Brunswick in 1902, where he has since been engineer and manager for the engineering and contracting company which bears his name. Mr. Vaughan is a Member of the American Institute of Electrical Engineers; the American Association of the Advancement of Science; and the American Electro Chemical Society; and an Associate Member of the Radio Engineers.

Lt.-Colonel H. L. Trotter, A.M.E.I.C., and C. L. Cate, A.M.E.I.C., have moved into new offices in the New Birks building, Montreal. Lt.-Colonel Trotter, who is a graduate of R.M.C., 1903, and was for eleven years prior to the war on the staff of Ross Holgate (and later, Henry Holgate), of Montreal, has, since returning from overseas, been with Messrs. Morrow and Beatty, contractors, as chief engineer on the construction of the new power plant of the Abitibi Power and Paper Company, on the Abitibi river. Mr. Cate is a graduate of McGill, 1909, and was on the staff of Henry Holgate during the years 1911 and 1912, and later, on bridge and dam construction in eastern Canada. He was overseas with the Imperial Naval Service, and upon his return, acted as district engineer for the Foundation Company, carrying out extensive alterations to the Lake St. Francis dam for the Quebec Government.

Lt.-Colonel C. N. Monsarrat, M.E.I.C., consulting engineer, Montreal, and Prof. C. R. Young, M.E.I.C., consulting engineer and assistant professor of structural engineering at the University of Toronto, are the Canadian representatives appointed on the advisory board of engineers in connection with the construction of the Detroit-Windsor bridge. Lt.-Col. Monsarrat was chairman and chief engineer of the board of engineers connected with the erection of the present Quebec bridge. According to the plans the bridge will have a clear span of 1,803 feet and a minimum clearance above water level of 110 feet, and when completed, Lt.-Col. Monsarrat said, will be the largest suspension bridge in the world. C. E. Fowler, M.E.I.C., vice-president and chief engineer of the American Transit Company of Detroit, is chief engineer of the advisory board, and in addition to Lt.-Col. Monsarrat and Prof. Young, the board includes, M. Pegran, chief engineer of the Interurban Rapid Transit Company, and Prof. Wm. H. Barr, consulting engineer, New York.

Lt.-Colonel Charles G. DuCane, O.B.E., A.M.E.I.C., who is well and favourably known in Canada, particularly in British Columbia where he was head of a successful consulting engineering organization, is now associated with the firm of Sir John Wolfe Barry & Partners, London, England.

Colonel DuCane has had a very interesting and successful military career. On the outbreak of war he enlisted for war service and was appointed superintending engineer on the construction of Witley camp which afterwards became a Canadian camp. In March 1915, he went to Russia to prospect a route for the Murman railway returning in July of that year. On August 21st 1915, he obtained a commission as Captain with the Royal Engineers and four days later was in France, second in command of the 3rd Labour Battalion, Royal Engineers, and in September 1916, he was appointed water-supply officer for the 3rd Army in France, and in January of the following year he formed and commanded the 352nd (electrical and mechanical) Company, R.E. with the rank of Major. He carried on the duties of water-supply officer of the 3rd Army and officer commanding the 352nd Company, R.E., from June 1918 to March 1919. He was attached to the staff of the engineer in chief, General Headquarters, France, as inspector of R.E. machinery with rank of Lt.-Colonel. The chief duties of this position included the acting as advisory, to engineer in chief, in all matters connected with water-supply schemes, materials, and plant, and workshops, as well as acting as liaison officer between the engineer in chief and the engineering operations of the various armies.

Lt.-Colonel DuCane was three times mentioned in dispatches, was granted the distinction of O.B.E., and on being demobilized on March 20th 1919, was granted the honorary rank of Lt.-Colonel.

One of The Institutes' Western Councillors.

Harry Linwood Johnston, Member and Councillor of *The Engineering Institute of Canada* and Member of the Professional Engineers of British Columbia, was born on August 29th, 1862, in Fredericton, N.B., and received his early education at the Fredericton Grammer School and through private tuition. Mr. Johnston's first engineering work was with the Canadian Pacific Railway, when at the age of twenty he went to Western Ontario as chainman on location surveys, and with the exception of two years as district engineer of the British Columbia Public Works Department, he has constantly followed his first field of engineering endeavour, railway engineering. The following chronological account of his rise in the profession shows the persistency with which he followed that first choice.

Commencing in May 1882, with the Canadian Pacific Railway as chainman, north of Great Lakes under H. E. C. Carry, M.E.I.C., and for eighteen years, between the years 1882 and 1905, with that company on location, construction and maintenance; in 1887 resident engineer at Algoma Mills under F. F. Busteed; in 1888 resident engineer on Seattle Lake Shore and Eastern Railway, near Spokane, Washington; 1891-1893, transitman on location and resident engineer

on construction with the Great Northern Railway in Cascade Mountains, Washington; 1894-1905, assistant engineer, engineer in charge and roadmaster on Canadian Pacific Railway in British Columbia; August 1905 to 1911, location and construction engineer on Grand Trunk Pacific Railway in Manitoba, Saskatchewan, Alberta, and at Prince Rupert, British Columbia. (This included charge of first fifty-three miles, Prince Rupert east, and estimating and finishing the first 103 miles); 1911-1917, location and construction engineer, Canadian Northern Railway and as division engineer stationed at Kamloops and Savona; 1917-1919, district engineer, Public Works Department of British Columbia at Vancouver; 1919—November 1920, division engineer Canadian National Railways at Armstrong, B.C., and from the latter date to the present time acting district engineer at Victoria, B.C.

Mr. Johnston was admitted as a Member in *The Institute* on June 19th, 1917.

The Engineering Index—1921

The Engineering Index for the year 1921 has just been published by the American Society of Mechanical Engineers. This volume is prepared along the general lines employed in the two previous volumes, issued since the publication was taken over by the Society, and contains indexed summaries of articles from over six hundred periodicals, published during 1921. The monthly index which appears each month in *The Engineering Journal* is prepared by the American Society of Mechanical Engineers and all abstracts of articles listed in *The Journal* during the year 1921 are included in the volume just issued. Abstracts of articles which have appeared since the close of 1921 are published monthly in Mechanical Engineering and *The Engineering Journal.*

EMPLOYMENT BUREAU
AND
MEMBERS' EXCHANGE

To make this department more valuable it is proposed that in future advertisements of situations vacant should state salary, and give details of requirements.

Situations Wanted

Civil Engineers and Draughtman

Graduate civil engineer, Jr.E.I.C., 28, single, desires position at once. Over two years experience in paper mills on general plant maintenance work, machine repairs, new installations, building revamping in concrete and steel, re-layout of machines with piping, etc. Design and detail for new construction and survey work. Good references. Salary expected \$165 — \$180. Apply Box No. 102.

Mechanical Engineer

Mechanical engineer, A.M.E.I.C., B.Sc., Canadian, age 29, single; seven years experience on air machinery and other machine design and as plant engineer. Open for immediate engagement, as mechanical engineer with machinery manufacturing firm or in similar work, preferably in Quebec or Ontario. Salary wanted \$275.00 per month. Apply Box No. 103.

Members' Exchange

Members having copies of the August 1921 issue of *The Engineering Journal* which can be spared will oblige the Secretary by mailling to headquarters.

* * *

Queen's Alumni of Montreal, Elect. Officers

At the fourth annual meeting of the Queen's University Alumni Association of Montreal, the following members of *The Engineering Institute of Canada* were elected to the executive:—R. O. Sweezey, M.E.I.C., President, A. C. Mallock, S.E.I.C., Secretary-Treas., B. E. Norrish, A.M.E.I.C., member of the Executive. Mr. Sweezey was also appointed as a member of the Council of the University.

ELECTIONS AND TRANSFERS

At the meeting of Council held on May 22nd, 1922, the following elections and transfers were effected: —

Members

Akins, James Robert, B.Sc., (Queen's Univ.) D.L.S., A.L.S., chief of party, Topog'l. Surveys Branch, Dept. of the Interior, Ottawa, Ont.

Goodwin, Leo. Frank, Ph.D. (Heidelberg), professor chemical engr'g., Queen's University, Kingston, and conslt'g. work.

Harcourt, Frederick Young, B.A., Grad. S.P.C., district engr., Port Arthur and Fort William District, Pub. Wks. Canada.

Hill, Lionel Coke, special designer and representative, John S. Metcalf Co., Montreal.

Jones, James Dyer, general manager, Algoma Steel Co., Sault Ste. Marie, Ont.

Marshall, John H. G., B.Sc., (Queen's Univ.), patent examiner, Patent Office, Ottawa, Ont.

Meadows, William Walter, (Grad. S.P.S. Univ. of Toronto), O.L.S., district surveyor and engr., Dept. of Highways, Regina.
Morgan, A. Hedley, works mgr., and engr., E. Leonard & Sons, London, Ont.
Shanks, Thomas, B.A.Sc., (Univ. of Toronto), D.L.S., Acting Surveyor General in charge of Topog'l. Surveys Branch, Dept. of the Interior, Ottawa, Ont.
Turner, John Harrison, of Coalhurst, Alta.
Underhill, George Gardner, C.E. (Cornell Univ.), director and mgr., Fraser Brace, Ltd., Montreal, Que.
Waugh, Bruce Wallace, B.A.Sc. (Univ. of Toronto), D.L.S., Topog'l. Surveys Branch, Dept. of the Interior, Ottawa, Ont.

Associate Members

Clark, Hial Jackson, B.A.Sc., (Univ. of Toronto), asst. and supt., H. T. Routley, highway contractor and engr., Toronto, Ont.
Dale, William Percival, B.A.Sc., (Univ. of Toronto), township engr., for the township of Stamford, Welland County, Niagara Falls, Ont.
Fletcher, Hugh Murray, (Grad .S.P.S. Univ. of Toronto), of Hamilton, Ont.
Fraser, Robert James, hydrographer and officer in charge, Gulf of St. Lawrence Hydrographic Surveys, Dept. of the Naval Service, Ottawa, Ont.
Garland, Charles H. B., (Grad. R. M. C. Kingston), asst. to engr. in charge, Geo. C. Graves Constrn. Co., Ottawa, Ont.
Hamel, Fernand Omer, acting senior mech. engr., Heating and Ventilation, Dept. Public Works, Ottawa, Ont.
Hotchkiss, Cyrus Percival, B.Sc. (Univ. of Alta.), D.L.S., A.L.S., chief of party, D.L. Surveys, Dept. of the Interior, Ottawa, Ont.
Hughson, William George, B.Sc. (Queen's Univ.), surveys laboratory, Dept. of the Interior, Ottawa, Ont.
Macdonald, Colin Stone, D.L.S., chief of party, Dom. Land Surveys, Ottawa, Ont.
Moore, Thomas John McLuckie, power development engr., Ont. Hydrometric survey, in charge of work and surveys in Northern Ontario, North Bay, Ont.
Murphy, Stephen John, B.Sc. (McGill Univ.), Topog'l. Surveys Branch, Dept. of the Interior, Ottawa, Ont.
Planche, Clifford Carlyle, B.Sc. (McGill Univ.), junior hydrometric engr., Dominion Water Power Branch, Calgary, Alta.
Prittie, Lloyd Conn, B.Sc. (Queen's Univ.), asst. patent examiner, Patent and Copyright Office, Ottawa, Ont.
Ralph, John Herbert, electrical engr., Dept. of Public Works, Ottawa, Ont.
Rowley, Harry William, B.Sc., (Mich. Agric. Coll.), district water-master, under S. G. Porter, C.P.R., Dept., Natural Resources, Coaldale, Alta.
West, Arthur Elemere, chief dftsman., Canadian Bridge Co., Walkerville, Ont.

Juniors

Drybrough, John, of Toronto, Ont.
Kuhring, Paul Ludwig, Junr. engr., River St. Lawrence Ship Channel, Marine Dept., Ottawa, Ont.
Libby, Philip Nason, B.S., (Forestry — Univ. of Maine), of Montreal, Que.

Associates

Jarvis, Richard Raymond, manager, Marks & Clerk, Ottawa, Ont.
Trainer, David, building contractor, Calgary, Alta.

Transferred from the class of Associate Member to that of Member

Bucke, William A, B.A.Sc., (Univ. of Toronto), manager, apparatus sales dept., Can. Gen. Elec. Co., Toronto, Ont.
Cameron, Joseph George, B.Sc. (Queen's Univ.), county engr., under the "Highways Improvements Act" for the united counties of Stormont, Dundas & Glengarry.
Carpenter, Henry S., B.A.Sc., (Univ. of Toronto), D.L.S., S.L.S., O.L.S., deputy minister and chief engr., dept. of highways, Regina, Sask.
Connor, Arthur William, B.A., C.E. (Univ. of Toronto), consltg. and supervising struct'l. engr., Toronto, Ont.
Hogg, Thomas H., B.A.Sc., (C.E.) (Univ. of Toronto), acting hydraulic engr., H.E.P.C., of Ontario, Toronto, Ont.
Mackenzie, Allan Campbell, engr., mtce. of way, Eastern Lines, C.P.R., Montreal, Que.
MacKinnon, George Douglas, B.A.Sc., (McGill Univ.), Vice-Pres., and Managing Director, MacKinnon Steel Co., Ltd., Sherbrooke, Que.
Rankin, John, B.A.Sc., (McGill Univ.), of Ottawa, Ont.
Sutherland, William H., B.A.Sc., (Univ. of Toronto), asst. engr., Montreal Water & Power Co., Montreal, Que.
Trotter, Harold L., (Grad. R.M.C. Kingston), Trotter & Cate, civil electrical engrs., New Birks Bldg., Montreal Que.
Winterrowd, William Holland; B.S. M.E., (Purdue Univ.), chief mech. engr., C.P.R., Montreal, Que.

Transferred from the class of Junior to that of Associate Member.

Adams, William Douglas, (Grad. R.M.C. Kingston), asst. engr., Toronto Transportation Commission, Toronto, Ont.
Crouch, William Wesley, B.C.E., (Univ. of Manitoba), res. engr., Black & Veatch, consltg. engrs., Kansas City.
deValter, Roger Audoir, junior engr., district of Quebec, Dept. Public Works, Canada.
Johnston, Bruce Alexander, B.C.E. (Univ. of Manitoba), bridge engr., Good Roads Board, Manitoba, Winnipeg, Man.
Johnston, George William Frederick, B.A.Sc., (Univ. of Toronto), contracting engr., Canadian Des Moines Steel Co., Ltd., Chatham, Ont.
Schofield, Stewart, B.C.L.S., engr., architect's office, C.N.R., Winnipeg Man.

Transferred from the class of Student to that of Associate Member.

Grange, Edward Rochfort, B.A.Sc., Univ. of Toronto), Air Certificate Examiner, Air Board, Ottawa, Ont.
Stark, William Hardy, B.A.Sc. (Univ. of Toronto), instr'man., Niagara Falls Power Co., Niagara Falls, N.Y.

Transferred from the class of Student to that of Junior.

Campkin, Wilbert Lee, head switchman (asst. wire chief), Sask. Govt. Telephones, Regina, Sask.
Fultz, Stephen Lloyd, B.Sc., (C.E.), (N.S. Tech. Coll.), res. engr., and asst. supt. on constrn., Nova Scotia Power Commission, Halifax, N.S.
Malone, Charles Edmund, of Kingston, Ont.
Paterson, David Roy, asst. city engr., Galt, Ont.
Pearson, Charles, constrn. engr., on rly. constrn., La Romana, Santo Domingo.

BRANCH NEWS

Montreal Branch

J. L. Busfield, M.E.I.C., Secretary-Treasurer.

Railway Refrigerator Car

On Thursday evening, April 20th, with F. A. Combe, M.E.I.C., presiding, W. H. Winterrowd, A.M.E.I.C., chief mechanical engineer of the Canadian Pacific Railway gave an address on a "Railway Refrigerator Car". Following the address there was a discussion in which a number of members took part. It is anticipated that Mr. Winterrowd's paper will be reproduced in a future issue of *The Journal.*

Recent Developments in Concrete

On Thursday evening, April 27th, the last meeting of the season, an address was given on the above subject by Lieutenant-Colonel H. C. Boyden of the Portland Cement Association. Colonel Boyden's address was largely based on the results of the experiments which have been made since 1914 by Professor Abrams of the Lewis Institute, Chicago.

The speaker said that until recent years the progress of concrete had been left to constructors supplemented with some laboratory investigation on a small scale. As a result of lack of definite knowledge erroneous ideas had developed, and because of such ideas enormous losses have been caused. In the United States last year, a year not normal in construction, $1,000,000,000 had been spent for concrete in various forms. Owing to the fact that the fundamental laws of mixing had not been carried out, that work could have been increased in value by 25 per cent, and in his personal opinion 33 per cent, a loss in value alone of from $250,000,000 to $330,000,000. Briefly, the owners were not getting what they had paid for.

Colonel Boyden then explained the foundation of the laboratory, where tests are conducted at the rate of 75,000 a year. The head of the Institute had been given an ample endowment, not to waste, but enough to carry out experiments and investigation until he was able to find out the right answer. It was five years before the first investigations were made known. Some investigations had been going on for two years and the solution would not be arrived at for two or three years, and perhaps ten, but it would mean the right answer, and it would not be given out until ready. There was only one instruction given to Professor Abrams, and that was: Find out all about Concrete. As a result of the work already done, Colonel Boyden said that he was able to deal with known facts.

There followed a review of the mixing of concrete, a talk on the ingredients, cement, sand, stone and water, with emphasis laid upon the necessity for clean sand. It was pointed out that dirty sand would lessen the compressive strength of concrete by 25 per cent. While much discussion had taken place about the first three ingredients, the water had been practically neglected and yet water was the controlling factor in the making of good concrete. This led to a lengthy review of the water-cement ratio. The less water used for a given amount of cement the stronger the concrete. The more water used, the weaker the concrete.

Colonel Boyden dealt with the new form of specifications, criticized building codes and declared that many designers were working on the factor of safety, because they had not the courage to say to the contractors: Give us the proper concrete. Under the new knowledge it is possible to buy concrete as a finished product.

As an example of construction erected under the Abrams specifications, Colonel Boyden instanced the new building of the Canada Cement Company on Phillips Square, Montreal, a $2,000,000 structure, where the average variation was only 1 3/10 per cent from the desired result. This he quoted as an example of the manner in which the members of the association are willing to work upon their own ideas.

The lecturer went into many details of his views on practical mixing, and later gave a number of views to indicate the proper consistency. Some of it poured so freely as to be termed "soup" and that was regarded as a very poor form indeed. The hardening of concrete, was not, he said, a drying out process but a chemical action. By keeping concrete wet for twenty-one days it would double the compressive strength and wearing ability.

At the close of the lecture there was a long discussion which lasted until after midnight. O. O. Lefebvre, M.E.I.C., chairman of the Civil Section of the Branch, presided.

Papers for 1922-23 Season

There was recently held a full meeting of the Papers and Meetings committee of the Branch, under the chairmanship of H. W. Fairlie, A.M.E.I.C. The chairmen of the various Sections are now engaged in arranging a programme for next season and it is hoped that any member who may be thinking of preparing a paper, will communicate with a member of the Papers and Meetings committee as given on the folder of Montreal Branch officers, recently mailed to all members.

Border Cities Branch

J. Clark Keith, A.M.E.I.C., Secretary-Treasurer.

The April monthly meeting of the Border Cities Branch was held in the Cadillac Cafe on the 21st., having been postponed for one week due to Good Friday. At the request of the chairman who was unavoidably absent, W. H. Baltzell, M.E.I.C., occupied the chair. Regret was expressed at the absence of M. E. Brian, A.M.E.I.C., due to illness. At the time the notices were posted Mr. Brian was to have been the speaker for the evening and the branch had looked forward with much interest to his "Experiences as City Engineer". The following members were present: Messrs. Baltzell, Bowman, Considine, Fletcher, Flett, Johnston, Keith, McIntyre, McMordie, Nelles, Newman, Porter, Smith, Thorne. The minutes of the previous meeting were read and approved.

The opinion was asked of the meeting if it was their desire to proceed with the election of a vice-chairman. After this was affiirmed, W. H. Baltzell, M.E.I.C., was elected, on the first ballot, as vice-chairman for the balance of the ensuing year.

J. J. Newman, M.E.I.C., read a communication from Willis Chipman on the progress being made with legislation in Ontario. The secretary announced that Colonel Boyden of the Portland Cement Association has been secured as the speaker of the May meeting to be held on the 19th. It was suggested that an invitation be sent to the secretary and all members of the local branch of the Institute of Architects. It was also decided that in view of the wide spread interest in concrete that an open meeting be held, that dinner be dispensed with and that suitable quarters be obtained for the meeting.

The Papers committee provided a most interesting and profitable evenings entertainment by securing four speakers to address the branch briefly on any subject they desired. The papers were varied and the discussions were entered into by everyone present.

A. J. Bowman, A.M.E.I.C., chose as his subject "Roads". The Essex Border peninsula is deficient in stone and the roads here are therefore of gravel or concrete, the gravel being obtained from the rivers and transported by rail or boat. If by boat, it is handled in three stages; screening and loading — to the skip — the mixer — then finishing. Flat screens prove more efficient than rotary or cylindrical. This item of cost may run from five to forty cents a yard depending on the capital outlay.

On large jobs, industrial rail provides cheapest haul, while trucking comes next if haul is from one to five miles. Teams can compete with trucks on a two-mile haul if roads are sandy or if light bridges are an obstacle. On short hauls of one-half mile or less it should be direct from loading bin to hopper, to mixer so as to eliminate a wastage of 5 to 10 per cent in deposition. The annual overhaul cost of plant is from 10 to 15 per cent of the capital outlay. The various methods of finishing roads were presented in detail. Discussion centered on the cracking of concrete roads. The speaker thought it could be attributed largely to poor rolling plus improper drainage. J. J. Newman, M.E.I.C., believed that as long as a road bed is uniform, rolling is secondary. If there are fills on the side, then rolling is important.

E. F. Considine, M.E.I.C., dealt with "Inconsistencies in specifications on the same kind of work in different jobs", more particularly in relation to timber crib breakwaters. He quoted from specifications on three Public Works Department contracts at Port Arthur, Toronto and Fort William. In one case all stone between 333 lbs. and 1,000 lbs. was rejected, in another the rejection limits were 150 lbs. and 450 lbs. while on the third, all stone between 150 lbs. and 4,000 lbs. could not be used. As any large breakwater job was necessarily a quarry proposition it was obvious that with the above variation in specifications that there would be a large percentage of quarried rock wanted. The quarrying cost would run from 30 cents to 50 cents a ton and one of two parties had to pay for it; the contractor or the owner.

Alex May gave the meeting the choice of two subjects, "Radio — Telephone" or "Engineering in India," and it was evident that the former is a popular pastime with members of the Branch as they were unanimous in its selection. There are two uses of the wireless telephone that present advantages from the standpoint of the transmission system operator. The first is the "wired wireless" (really current carrier in which a high frequency current is used), and the second is the radio telephone which has developed from the radio telegraph. A rough estimate at the present time shows that there are 25,000 amateur transmitting stations in the United States and more than 600,000 receiving stations.

Present radio laws were established before the time when the radio telephone came into the field on a basis that would permit of more than experimental work. The broadcasting of musical programmes was thought to interfere with other radio traffic and a conference was recently held in Washington to draft regulations and legislation. Interference by amateurs and certain atmospheric conditions present two problems to the commercial operator. The dangers due to improperly grounded amateur sets was dwelt upon at length and this one phase of the question entered largely into interesting discussion.

J. S. Nelles, A.M.E.I.C., chose a subject which in view of the interest of this district in the present Minister of Railways was very appropriate. He dealt with the Hudson Bay railway which forms part of the system of Government railway lines. The total length when constructed from The Pas to Port Nelson will be 424 miles of which 214 miles are now in operation, steel having been removed from 118 miles for war purposes. Grading has been completed throughout. The rail and boat haul from central Saskatchewan to Liverpool via Port Nelson is shorter by 900 miles than via Montreal to say nothing of the saving in rail haul. The country is not generally suited for agriculture but is rich in minerals, fish and fur bearing animals. The difficulties of construction were touched upon with particular reference to frost which is permanent a short depth below ground surface.

Peterborough Branch

D. L. McLaren, A.M.E.I.C., Secretary.

"Recent Developments in Concrete"

On April 24th the Peterboro Branch were given an opportunity to hear a very interesting lecture on "Recent Developments in Concrete", given by Colonel H. C. Boyden of the engineering staff of the Portland Cement Association. For the past year the speaker has been giving similar addresses before various engineering and public organizations, both in the United States and Canada.

Colonel Boyden sketched briefly the history of the cement industry, and spoke regarding the method of mixing and pouring concrete as recommended by the Portland Cement Association, in that the concrete structures are designed for a certain stress in the concrete, and the concrete is made with the proper proportions of cement, sand, stone and water, to give this required strength. He also stated that the engineers for the Hydro Electric Power Commission had adopted this practice in the construction of the Queenston - Chippawa canal with most satisfactory results.

"Scientific Industrial Research"

On April 27th a very interesting and instructive address was given by Colonel F. M. Gaudet, C.M.G., M.E.I.C., technical executive officer of the Research Council of Canada. The speaker outlined the need of a laboratory for scientific and industrial research, and he gave the following examples, to show that such research pays:—

1. American industries are spending $20,000,000 each year for scientific research. They know that it pays. The United States Federal and State Government appropriated $57,000,000 for research in 1919.
2. The General Electric Company investigated the properties of tungsten, and by the use of a few hundred pounds for electric lamps, a saving of $250,000,000 annually is made in the United States alone.
3. E. I. DuPont de Nemours and Company of Wilmington, Delaware, manufacturers of explosives and chemicals, estimate that their research laboratory has yielded a profit of $82,401,000 from 1912 to 1918, inclusive. This represents an annual rate of 1,370 per cent on their investment for research.
4. The Gayley invention of the dry air blast in the manufacture of iron, saves $30,000,000 a year.
5. The American Telephone and Telegraph Company has appropriated $25,000 a year for five years, to be used by the American National Research Council.
6. The Mellon Institute was established by the Mellon brothers, bankers of Pittsburgh, (one of whom is now head of the Treasury Department at Washington), shrewd business men, who know that it pays to provide manufacturers with a scientific laboratory. They have recently donated an additional sum of $1,500,000 to their original gift of several millions to the Institute which bears their name.
7. As a result of discoveries made at the Mellon Institute, the American Bread Company has been able to save $1,500,000 a year in one of its departments.

8. John D. Rockefeller, looking about for the best way to make his great fortune serve humanity, set apart $200,000,000 for scientific research.

9. Highly organized research in the development of agricultural machinery has, in the United States, reduced the labour cost of seven crops by $681,000.000 as compared with the methods of only fifty years ago.

10. The work of Coolidge and Langmuir, in developing the nitrogen tungsten lamp now extensively used, has reduced the consumption of the electric current to one-seventh of the former quantity.

11. Michael Faraday discovered the principle of the dynamo electric machine in the last century, and, without this knowledge, the whole art of electrical engineering could not exist. The value of electri power generated in Canada is $60,000,000 of which one-third is exported

12. The telephone was invented by Dr. Alexander Graham Bell, a Canadian scientist, and Canada has nearly one million telephones representing a capitalization of $100,000,000. The telephone company spend annually for research, the results of which are all about us, a sum greater than the total income of many universities, and the enormous amount saved by the use of the telephone is incalculable.

13. The Frasch process of refining crude sulphur-bearing Canadian and Ohio oils has increased their value sevenfold.

14. Aluminum was discovered by a German chemist, and originally cost $90 a pound. It is now manufactuted at Niagara and Shawinigan Falls, and the scientific work done by Hall and Heroult has reduced the cost from $90 to 22 cents a pound.

Annual Meeting

The Annual Meeting was held on the 11th inst. Reports were received from the chairman, secretary, treasurer, and convenors of the various committees and the officers for the ensuing year were elected.

The General Secretary of *The Institute*, Fraser S. Keith, M.E.I.C., was present and spoke to the Branch on Institute affairs.

Victoria Branch

H. M. Bigwood, A.M.E.I.C., Secretary.

The chief activity of the Branch during April has been concerned with the new Esquimalt dry dock under construction by P. Lyall and Son Ltd., for the Dominion Government. At the regular meeting held on Wednesday, April 26th, J. P. Forde, M.E.I.C., district engineer of the Public Works Department of Canada explained in detail, with the aid of plans and photographs, the nature of the work and the progress made up to the time work was suspended at the end of March.

A visit to the site of the work took place on Saturday, April 29th. about forty members attending, among whom was J. G. Sullivan, M.E.I.C., president of *The Institute.* The description of the work given a few days previously by Mr. Forde was of great assistance to those visiting the work, enabling them to follow the course of construction without effort.

The contractors staff and the government engineers were untiring in their efforts to show and explain all details, their attention being much appreciated.

From the new work the party proceeded to the existing dry dock, a very small affair of 450 feet in length as compared with 1,125 feet for the new dock when completed. Much interest was shown in the pumping machinery with which this basin is equipped and which was built by James Watts, Birmingham, England, in 1876 and has been in continuous operation since about 1886.

At one o'clock the whole party met at lunch and the chairman of the Branch, P. Philip, M.E.I.C., took the opportunity to extend a hearty welcome from the Victoria Branch to the President of *The Institute.* Mr. Sullivan acknowledged the remarks in a short speech which while it was delivered in a few minutes left food for thought to occupy the minds of his hearers for a much longer time.

The branch has changed its headquarters from Belmont House to 25 Brown Building, Victoria. The executive were guided by two considerations in deciding on the change, economy and a desire to be more centrally located, both objects have been achieved.

During May a visit will be made to the Bamberton plant of the British Columbia Cement Company, and an address on concrete will be given by Professor Duff A. Abrams, M.E.I.C. director of the Structural Materials Research Laboratory, Lewis Institute, Chicago.

Cape Breton Branch

Kenneth G. Cameron, A.M.E.I.C., Secretary-Treasurer.

On Tuesday April 25th, a special meeting of the Branch was called to meet Walter J. Francis, M.E.I.C., vice-president of *The Institute,* who was in the City for one day only. Previous to leaving on the evening train, he addressed some thirty members on general Institute affairs. He mentioned in particular that *The Institute* in its present condition really resolved itself into an aggregation of Branches, with whom the chief activities rested, the policy being guided by Headquarters and Council.

One of the chief difficulties faced is that of distance, making the conduct of business and management at Headquarters both onerous and lengthy. Mr. Francis spoke of the work of Council and its methods of procedure, and also of the work covered during the recent meeting of the committee on Policy. In order to achieve success he emphasized the absolute necessity of co-operation.

Mr. Francis' address was much appreciated and, while it was regretted that his time was so limited, the sincere thanks of the Branch were extended to him for having made time to meet us.

Annual Meeting

The annual meeting of the Branch was held on May 9th; very poor weather conditions causing a small attendance. The secretary read the annual report which follows:—

Mr. Chairman and Gentlemen:—

The last annual report submitted May 26th 1921, covered only the five months since the Branch was started. This report, therefore, is the first to cover a full year's operations.

Membership

When the Branch was started there were seventeen members of all grades in the district. At the time of the last annual meeting the roll stood at fifteen, with nineteen applications pending. Today there are eight applications pending with forty-one members in good standing, made up as follows: nine Members, twenty-four Associate Members, six Juniors, one Student, and one Associate.

Meeting

During the past Winter session six regular meetings have been held as follows:

Nov. 9th.	General Business.
Dec. 9th.	Paper by W. S. Wilson, A.M.E.I.C.
Jan. 6th.	Paper by R. M. McKinnon, A.M.E.I.C.
Feb. 9th.	Paper by Geo. D. Macdougall, M.E.I.C.
Mar. 9th.	Paper by S. C. Mifflen, A.M.E.I.C.
Apr. 4th.	Paper by I. W. Buckley, A.M.E.I.C.

In addition two special meetings have been held; a dinner and social on March 23rd, and a meeting addressed by Mr. Francis, vice-president of *The Institute*, on April 25th; making eight meetings in all.

Ten meetings of the Executive committee have been held during the year. In addition to routine business, the principal work covered was consideration and classification of applications, business arising from the Branch Secretarial Conference, particularly extensive revisions of bylaws, and consideration of the request of the Minister of Public Works for co-operation in regard to the Provincial Act covering boiler manufacture and inspection.

Financial Statement

Although the finances of the Branch can hardly be said to be in a flourishing condition, it has still been possible to complete the year with a favourable balance. Considering the size of the Branch, we have undertaken more than is usual with other Branches of the same size in the matter of the rental for rooms, and, while this has necessitated making a local contribution, it is still to the credit of the Branch that, in spite of hard times, the members have responded sufficiently well to enable us to keep clear of debt so far. In order to maintain this position, and to accumulate a small surplus sufficient to meet emergencies, members are asked to co-operate to the best of their ability in this matter.

The balance in hand at the last annual meeting was	$40.08
Total receipts for the year have amounted to	174.01
Total expenditures for the year amount to	207.73
Leaving a balance in hand on May 8th 1922, of	6.36

Details of the financial statement were appended. On the motion of D. S. Morrison, A.M.E.I.C., seconded by C. S. Creighton, Jr.E.I.C., the report was received and adopted.

The chairman, C. M. Odell, M.E.I.C., then read the report of the scrutineers, and declared the following officers elected,—

Chairman, C. M. Odell, M.E.I.C.
Secy-Treas. K. G. Cameron, A.M.E.I.C.
Exec. Com. (one vacancy, 1922-24) A. W. MacMaster.

It was moved by S. C. Mifflen, A.M.E.I.C., seconded by A. W. MacMaster, A.M.E.I.C., and carried, that for the future the secretary be exempted from paying local dues.

The chairman then asked that all members who had any ideas which would contribute to the success of the Branch would bring the same forward; adding that while the executive was doing its best in the members' interest, they would nevertheless appreciate any constructive criticism.

Speaking of the coming meetings of the Mining Society of Nova Scotia in Sydney, Mr. Odell then, as vice-president of that Society, issued an invitation to all members of the Branch to be present at the meetings.

At the conclusion of the official business, the chairman gave a short address on the subject of Transportation.

On the following Thursday, a meeting of the Executive committee was held, when K. H. Marsh, M.E.I.C., was appointed vice-chairman of the Branch. Mr. Marsh is chief engineer of the Dominion Steel Corporation and during the past year has acted as chairman of the Papers and Meetings committee, and the Branch is much indebted to him for his energetic work in that connection which has contributed so largely to the successful season just past.

At the same meeting the following Papers and Meetings committee was appointed for the ensuing year,—

H. Longley, M.E.I.C., K. H. Marsh, M.E.I.C., T. J. Brown, M.E.I.C., C. C. Curtis, M.E.I.C., and S. C. Mifflen, A.M.E.I.C.

Niagara Peninsula Branch

Rex. P. Johnson, A.M.E.I.C., Secretary-Treasurer.

The annual meeting this year was the occasion of a dance held at the Prince of Wales hall in St. Catharines on May 5th. A special car was run from Niagara Falls and this, along with several motors, conveyed about twenty couples to the festive gathering. About sixty couple participated in a very enjoyable evening and the members are much indebted to the excellent work of the committee in charge of the arrangements. The decorations were novel and typical, consisting of a camp fire setting and a skilful arrangement of transits, levels, rods, pickets, chains, etc. The orchestra platform was artistically decorated with palms and flowers. The dance committee consisted of F. S. Lazier, M.E.I.C., chairman; R. W. Downie, S.E.I.C., Secretary and W. H. Sullivan, M.E.I.C.

The necessary business was conducted by the chairman during the intermission. This consisted of the presentation of the annual report and financial statement, which the chairman advised would be published in *The Journal*, and the report of the scrutineers on the ballot for new officers and Executive committee. A vote of thanks was passed to the officers and Executive committee for its services to the Branch during the past year; to Mr. Grant for the use of a lantern on many occasions and to Mr. Butler for arranging for its transportation and operation, and to the Annual Meeting committee who so successfully arranged the evenings entertainment.

The new officers and executive committee are as follows:—Chairman, F. S. Lazier, M.E.I.C.; Vice Chairman, S. R. Frost, A.M.E.I.C.; Secretary-Treasurer, R. P. Johnson, A.M.E.I.C.; Executive Committee, F. W. Clark, (elected for a two year term), A. Milne, (elected for a two year term), R. W. Downie, S.E.I.C., (elected for a one year term) F. E. Sterns, A.M.E.I.C., (who is a member of the executive for his second term); Ex-Officio members, N. R. Gibson, M.E.I.C., Past Chairman, A. C. D. Blanchard, M.E.I.C., Councillor, H. G. Acres, M.E.I.C., Vice-President, Lt.-Col. R. W. Leonard, M.E.I.C., Past President.

Annual Report—April 1922

To the members of ihe Niagara Peninsula Branch;—

The following report is a supplement to the annual report presented to Council at the last annual meeting of *The Institute* and completes the record of the Branch activities to the end of the Branch year.

During the year the Branch has held five general meetings, two trips of inspection and four meetings of the Executive committee. A policy of holding general dinner meetings once a month during the winter has been followed. These meetings have been held alternately in St. Catharines and Niagara Falls, with an average attendance of seventy-eight for the Niagara Falls meetings and fifty-five for the St. Catharines meetings, and an average for all meetings of sixty.

The Branch has again lent its efforts towards securing legislation. All the local members of the legislature have been interviewed by various members of the Branch and close touch has been maintained with the Advisory Conference committee throughout the period that this matter has been active.

The total membership has remained constant during the year with a total of one hundred and thirty-three. The detailed classification is as follows:—

	1921	1922
Members	19	19
Associate Members	74	75
Juniors	20	22
Students	17	14
Associates	2	1
Affiliates	1	2
	133	133

A financial statement is attached hereto.

Respectfully submitted,

N. R. Gibson, *Chairman*
Rex Johnson, *Sec.-Treas.*

Financial Statement

May 6, 1921 to April 15, 1922

Receipts

Bank Balance May 6, 1921	$229.47
Rebates on members fees from Headquarters Jan. 1st, 1921, to Dec. 31, 1921	184.01
Rebates from the Journal for Branch News, Jan. 1st, 1921, to Dec. 31, 1921	40.58
Affiliates Fees	10.00
Commission on Advertising for Journal	28.50
Receipts from Members for Annual Meeting 1921	151.00
Outstanding cheque	2.25
	$645.81

Disbursements

Stenography	$ 39.71
Printing	64.90
Postage, telegrams, long distance phone, etc	13.01
Honorarium to Branch Secretary	100.00
Portion of Affiliates' fees to Headquarters for Journal subscription	4.00
Expenses of speakers and guests at meetings	16.00
Travelling Expenses of Branch Representative on the Executive of the Ontario Provincial Division	5.00
Expenses of Secretary attending meeting of Eastern Branch Secretaries, Jan. 1922	44.30
Expenses re Legislation	1.60
Expenses re Annual Meeting 1921	124.50
Appropriation for Annual Meeting 1922	150.00
Bank Balance April 15, 1922	82.79
	$645.81

We, the undersigned auditors, have audited the books and accounts of the Niagara Peninsula Branch of the Engineering Institute of Canada, and the vouchers thereof, and find the same correct.

S. W. Johnston
Norman Malloch
Auditors

The final regular meeting of the season was held in the Engineers' Club at Thorold on Wednesday evening May 18th, with N. R. Gibson, M.E.I.C., in the chair.

The speaker of the evening, Lt.-Col. H. C. Boyden of the Portland Cement Association of Chicago gave a very interesting instructive illustrated address on "Recent Developments in Concrete." As Lt.-Col. Boyden has addressed several of our branches it is unnecessary here to go into any details of his lecture, but the underlying text of his remarks will well bear repetition and should be kept in mind by all engineers interested in concrete, that is, that we can now buy concrete, not as a formula, but as a finished product. An interesting discussion followed the lecture in which S. R. Frost, A.M.E.I.C., R. W. Downie, S.E.I.C., N. R. Gibson, M.E.I.C., J. A. Grant, M.E.I.C., F. C. Jewett, A.M.E.I.C., R. P. Johnson, A.M.E.I.C., T. V. McCarthy, A.M.E.I.C., and others took part. E. M. Procter, A.M.E.I.C., of Toronto instilled considerable vigour into the debate with a defense of the old pit-run gravel concrete, but the sympathy of the meeting appeared to be with the more scientific methods.

Halifax Branch

O. S. Cox, A.M.E.I.C., Secretary-Treasurer.

The monthly meeting for April was held at the "Green Lantern" at which the chairman of the Branch presided.

After the supper, the usual concomitant of these monthly gatherings, H. B. Pickings, A.M.E.I.C., gave an interesting and instructive paper on "Some Problems in Surveying", with special reference to the difficulties and embarrassments with which the surveyor is confronted in attempting to reach the necessary degree of accuracy and finally in the delimitation of "lots, pieces and parcels" of real estate and to reconcile errors and discrepancies between ancient and often crudely prepared plans, deeds and descriptions, and present conditions and boundaries of properties. It was difficult and often impossible to find or identify the ancient marks and monuments delimiting a piece of property and therefore correspondingly so not only to adjudicate equitably between a seller and a purchaser, but to satisfy the legal requirements in the often complicated process of transferring property from one owner to another.

In the discussion which followed the chairman expressed the opinion that a vast amount of trouble would have been saved, if in the descriptions of properties by metes and bounds the true or astronomical meridian had many years ago been made compulsory in all surveys, plans, deeds and descriptions of properties, instead of the generally used magnetic bearings which vary from year to year and by local attraction from place to place. One or two members spoke of the frequent and often incorrect use of the term "more or less" in deeds and descriptions. The author of the paper, was opposed to the use of the phrase "except in the rare case where it was unavoidable". Several other members spoke upon other features of the subject which, while not strictly engineering surveying, was one with which engineers often came in touch.

A special meeting of the Branch will be held on the 10th of May, when the members are looking forward to hearing a most interesting paper on "Recent Developments in Concrete" by Lieut. Col. H. C. Boyden, Chief Engineer of the Portland Cement Association of Chicago.

The annual meeting of the Branch for th eelection of officers and other important professional and routine business will be held sometime during the month of May.

Moncton Branch

M. J. Murphy, A.M.E.I.C., Secretary-Treasurer.

The regular monthly meeting of Moncton Branch was held in the Council Chamber of the city hall, Moncton, on Tuesday, May 9th., J. D. McBeath, M.E.I.C., chairman presided.

Lt.-Col. H. C. Boyden of the engineering staff of the Portland Cement Association gave a very interesting address on the various phases of the art of making concrete. The address was illustrated by lantern slides. The meeting was open to the public.

Col. Boyden's remarks were listened to by a very large and interested audience, who added much to the meeting by the varied questions asked, which the speaker seemed only too well pleased to have the opportunity of answering. Mr. McBeath spoke very highly of the benefit he personally received by listening to Col. Boyden's address, and tendered him a very hearty vote of thanks from the members of the Moncton Branch.

The annual meeting of Moncton Branch was held in the Mayor's office, city hall, Moncton, on Thursday evening, May 11th. The chairman, J. D. McBeath, M.E.I.C. presided.

Second Annual Report of the Executive Committee of Moncton Branch of the Engineering Institute of Canada for the period between May, 1921 and May, 1922

The first annual meeting of Moncton Branch was held in the city hall, Moncton, on May 5th 1921. At this meeting the result of the ballot for officers for ensuing year was announced, and reports were read.

The secretary of Moncton Branch attended the Secretaries meeting held in Montreal last January and at this meeting each secretary present gave an outline of the activities of his particular Branch, and Moncton Branch certainly compares most favourably with the other Branches of *The Institute*, both in attendance and interest shown by the members.

The attendance at our meetings during the past year has been very good, particularly at our supper meetings which have proved most popular. The Executive committee met eight times and transacted a considerable amount of business. There were four meetings of the Branch in 1921 and nine in 1922. Papers were read, addresses given, important business transacted and moving pictures displayed at the meetings, as follows:—

October 6th, 1921, Motion pictures showing the construction and flight of Aeroplanes. These films were loaned by the Air Board of Canada.

November 3rd, 1921. At a supper meeting, F. H. Williams, M.Sc., A.M.E.I.C., delivered an address on "Electric Welding and its application in Railway Repair Shops", illustrated with lantern slides.

November 23rd, 1921. Dr. Henderson of the New Brunswick Gas and Oil Fields, Ltd., delivered an address on "Petroleum and Gas Production".

December 1st, 1921. At a supper meeting, K. H. Smith, M.E.I.C. delivered an address on "Hydro-Electric Power Development."

January 5th, 1922. At a supper meeting J. Edington, M.E.I.C., delivered an address on "History of Moncton Water-supply", and Mr. Holgate, chief engineer of McKinnon Bridge Company gave an interesting outline on the "Steel Construction of the Sunny Brae Rink".

January 19th, 1922, E. G. Evans, M.E.I.C., delivered an address on the "Toredo Navalis" ("The Ship Worm").

February 2nd, 1922. At a supper meeting, H. B. Pickings, A.M.E.I.C., delivered an address on "Town Planning."

February 15th, 1922. R. G. Gage, M.E.I.C., delivered an address on "Railway Signalling and Interlocking". This meeting was held in the Science building, Mount Allison University, Sackville.

March 2nd, 1922. At a supper meeting, C. O. Foss, M.E.I.C., delivered an addredd on "Hydro-Power Development in New Brunswick".

March 16th, 1922. J. D. McBeath, M.E.I.C., chairman of Moncton Branch, delivered an address on "Municipal Engineering". This meeting was held in the Science building, Mount Allison University, Sackville.

April 6th, 1922. At a supper meeting, F. B. Tapley, M.E.I.C., delivered an address on "Railway Maintenance".

April 20th, 1922. J. P. Wood delivered an address on "Richibucto Harbour Developments".

May 9th, 1922. Lieut.-Col. H. C. Boyden, B.S., of the engineering staff of the Portland Cement Association delivered an address on "Concrete".

At our annual meeting the membership was 44, which has increased to 66, an increase of 50 per cent, our membership is as follows:—

Members	9
Associate Members	27
Juniors	8
Students	19
Affiliates	3
	66

The sincere thanks of the members of Moncton Branch are due Major Wm. McKee and the various ladies and gentlemen who so kindly provided entertainment at our supper meetings.

We still continue our policy of giving as much publicity as possible to the Branch, in order to stimulate public interest in our activities.

The financial statement which will be submitted by the secretary, shows a surplus of $14.26, but as there are three months rebates now due from Headquarters for Branch news and members dues, our surplus will be greatly increased when this cheque is forwarded to us.

J. D. McBEATH, *Chairman*
M. J. MURPHY, *Sec.-Treasurer.*

Retiring President's Address

Gentlemen:

As this is the last meeting at which it will be my pleasure to act as your chairman, a short review of our activities during the year 1921-22, with a few impressions and suggestions, will probably not be misplaced.

The Branch started the year with a total membership of 44 which has since increased to 66, a gain of 50 per cent.

We might be pardoned in saying that we are proud of this showing, especially when several of the other branches have not shown a very large percentage of increase.

Vancouver Branch

P. H. Buchan, A.M.E.I.C., Secretary-Treasurer.

British Columbia Professional Meeting.

Rapid progress is being made on the final arrangements for the British Columbia Professional Meeting, which is to be held in Vancouver on June 16th and 17th. The Canadian Pacific Railway has very kindly placed a suitable meeting room in the hotel Vancouver at our disposal and the Committee is confident that with the unsurpassed facilities afforded by this beautiful hostelry, the reception and entertainment of our visiting members should be a pleasure to them as well as ourselves.

A word of explanation as to the change in the name of our meeting will not be amiss. Previously, we have been referring to the "Western Professional Meeting": but on the advice of Mr. Keith, we believe that "British Columbia Professional Meeting" is a better name, for by its adoption we will avoid possible confusion with the approaching professional meeting to be held at Winnipeg. In this connection, we also feel that same apology is due our Prairie brethren for our seeming neglect to more fully consult them in making our plans. Our difficulty has been the time at our disposal, due to our having seized the opportunity afforded by the holding of the Canadian Good Roads Congress at Victoria during the previous portion of the same week in June. The adjustment of dates could not be accomplished without a certain amount of negotiation, which crowded our own arrangements to such an extent that we found it necessary to "take the bull by the horns", so to speak, and complete the programme locally. We thoroughly appreciate the assurances we have received, that we have the support and good-will of our Western members; and although we have been compelled, through force of circumstances, to precipitate matters, we wish them to believe that their welcome will be none the less hearty when we meet them at hotel Vancouver on June 16th.

In regard to papers, the committee has tried to present subjects which will be both instructive and entertaining. A paper on "Town Planning" is being prepared in Montreal by James Ewing, M.E.I.C., which is expected to be of special interest to residents of British Columbia. As it is the intentions of the committee to invite representatives of a number of our public bodies to hear this paper, we are hoping that further interest will be afforded by a well-conducted discussion. A second paper on "Irrigation in British Columbia" is being written by Ernest A. Cleveland, M.E.I.C., consulting engineer to Department of Lands, Victoria, B.C., which, it is believed, will be of particular interest to our members from the interior of British Columbia and the Prairie Provinces. The third paper on "Engineering in the British Columbia Logging Industry" which is being prepared by T. W. Fairhurst, A.M.E.I.C., Vancouver, centres on one of our principal industries; and with its accompanying lantern-slide illustrations, it is expected to be of unique interest to all, as the handling of our heavy timber on steep mountain slopes in the immense quantities now demanded by our mills, is an ever-varying problem.

A luncheon will be held in the hotel Vancouver at mid-day on Friday, followed by a trip to the new Ballantyne pier on Burrard Inlet which is a large reinforced concrete structure in course of construction, embodying the latest ideas in port facilities for an ocean terminal.

Saturday morning is being reserved for business and the discussion of welfare, Policy and the proposed revival of the British Columbia Provincial Division, attention to which has been drawn in recent issues of *The Journal*. Short addresses are being arranged for on these questions, and it is hoped that much good will result from a thorough discussion of these matters.

The business of the professional meeting will terminate at noon, Saturday June 17th. The afternoon will be devoted to sightseeing, arrangements for which are now being made, and which we trust will materially add to the enjoyment of our visitors.

Calgary Branch

J. A. Spreckley, A.M.E.I.C., Secretary.

Floyd K. Beach, A.M.E.I.C., Branch News Editor.

Much attention has been given by *The Institute* and its members in the past to engineering problems involved in the design and construction of irrigation works. The economic use of irrigation water after works are complete has often been considered rather in the realm of agriculture than engineering. W. H. Snelson, A.M.E.I.C., in addressing the Calgary Branch on April 28th, brought out very clearly the fact that many agricultural problems under irrigation belong to the engineer, and his study of them using his specialized training, is doing much to make the constructional engineering that preceded him and in economic success.

In his address, Mr. Snelson first dealt with the history of irrigation work in the Western Provinces, which work has been carried on since the year 1913. Special reference was made to the work at the Strathmore station, where duties-of-water investigations were carried on by the Dominion Reclamation Service in co-operation with the Natural Resources Department of the Canadian Pacific Railway, similar investigations being later carried on at Ronalane, where a tract of land, comprising some twenty-three acres was secured for the purpose. This station was later abandoned for a more desirable one near Vauxhall. A number of irrigation investigations were described by Mr. Snelson, the purpose of which, in each case, was to secure reliable data relative to:

First,—The amount of water required to produce the maximum yield of specific crops, when grown under different conditions of soil fertility.

Second,—The proper depth of water to apply per irrigation for the different crops.

Third,—The relationship between the irrigation head and the distance apart of the distributing ditches.

Fourth,—The seasonal water requirements of crops or the time of irrigation.

Mr. Snelson also dealt with the subjects of fertility, food elements cultural methods and rotations, and in speaking of the water requirements a number of charts were used to demonstrate his points. Charts were also used to demonstrate the facts and figures on growing irrigated oats.

As evidence of the practical benefit irrigators are receiving from the results of the investigations, Mr. Snelson cited one or two cases as illustrations, one of which was: A farmer complained to that although he had made a large serviceable ditches and had received a good head of water, he had harvested a poor crop and experienced considerable trouble in irrigating. Upon examination of his field, it was found that his field laterals were from 200 to 500 feet apart. Investigations have shown that for the ordinary irrigating head say two and three second feet, field laterals in ordinary loam soil should not be farther apart than 100 feet, especially in new fields, and the farmer was advised wherein he had erred.

Owing to the popular nature of the address, the meeting was open to the public. That the subject was generally felt to be of live interest was evidenced by the large turnout of Board of Trade members other than engineers. Considerable discussion followed the address, and the discussion was entered into at length by a number of men outside the profession.

Alberta Engineering Legislation

The act of the Alberta Legislature to regulate the engineering profession and to incorporate the association of professional engineers, assented to April 10, 1920, did not contain the clause which at the time seemed to the sponsors of the bill to be very essential. It did not provide that persons wishing to practise must be registered. In fact at the time it seemed that the only thing gained was the patent of a name, for the only thing really gained was the limitation as to who had the right to call himself a "Registered Professional Engineer".

However, since the passage of the original Bill, another came up to regulate the manner in which irrigation districts may form themselves into corporations and governing the procedure that such corporations must follow. In this act was specified that only a "Registered Professional Engineer" may be employed by such districts in a professional capacity. Again in an act passed at the last session of the legislature the highways act contained parallel provisions.

The question of definition of the word *engineer* has long vexed the profession. It was one of the things, undoubtedly, that prevented the original act from passing, with a clause in it regulating practise. It now appears that every step taken so far has led in the right direction and each step has been logical. The prestige of the engineer has been enhanced in the province; machinery is in operation for legal recognition of the profession, and the association formed pursuant to the act is strong in numbers, contains the best of those who call themselves engineers, and is on a good financial footing.

Ottawa Branch

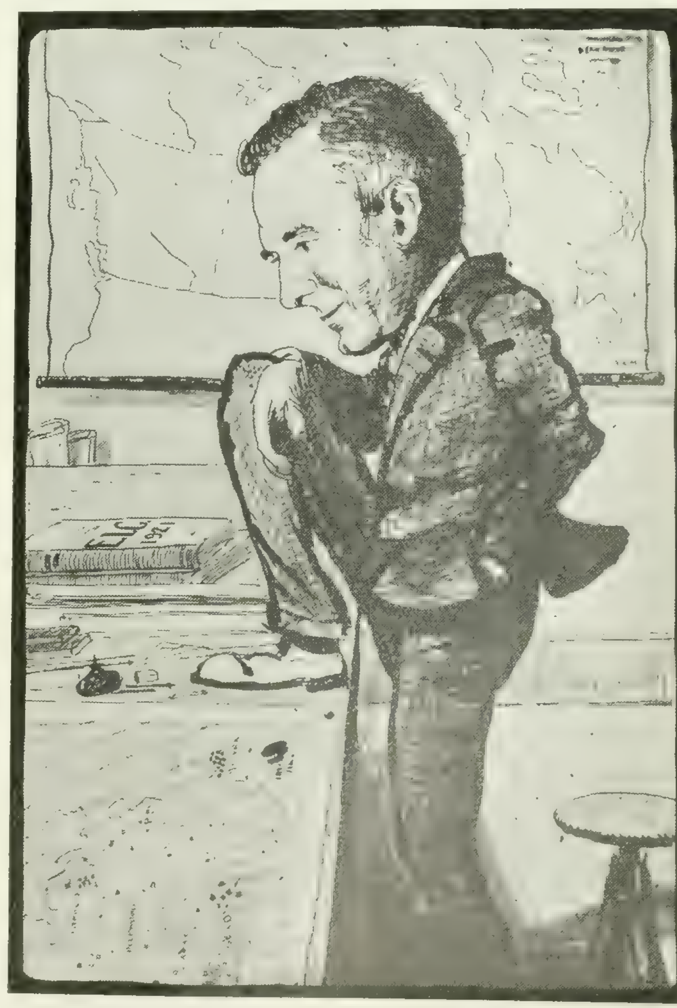
F. C. C. Lynch, A.E.I.C., Secretary-Treasurer.

World's Largest Single Power Development

The Ottawa Branch was told the story of the construction of the Chippawa power development on the evening of April 20th. The meeting was held in Victoria Museum, and the speaker was H. G. Acres, M.E.I.C., chief hydraulic engineer of the Ontario Hydro-Electric Power Commission and vice-presiden tof *The Engineering Institute of Canada.*

K. M. Cameron, M.E.I.C. chairman of the Ottawa branch, presided and introduced the lecturer as an old friend of twenty years standing. Mr. Acres had been intimately connected with the development of the work of the hydro-Electric Commission since its inception, and had played a large part in the investigation and subsequent development of the many water power developments of the Commission. The lecture was fully illustrated by lantern slides which admirably revealed the enormous task of the engineers, so successfully accomplished and without a single fatality, despite the use of some of the largest plant in the world. With a present capacity of 450,000 horse power, the plant was described as the world's largest. Although 5,600,000 pounds of dynamite, or six tons a day, were used in excavation of the canal channel, no accident happened.

The lecturer stated that three of the largest electrically operated shovels in the world were used for the work of excavating, and one of them was shown on the moving pictures dumping dirt at such a height that the lecturer said it would be equivalent to the shovel being on rails on Sparks street and lifting ten tons of dirt every 45 seconds to the top of the Hope building. The best record for one day's work was 8,600 yards of excavation. A dredger cutter which had been cutting at the rate of 6,000 cubic yards a day had its capacity increased to 10,000 yards a day by the simple device of welding a few teeth on to some of the blades. A cut 85 feet deep, at Lundy's Lane corner was another of the impressive features of the work illustrated by the pictures.



A "Bram-Wave" for the Annual Report.

Cement work of great magnitude was shown, and the lecturer said that fifteen cars of cement in twenty hours were put in last fall. The moving pictures revealed a car

load of sand and another car load of rock being dumped at the same time into hoppers for the making of concrete lining. Two huge penstock intakes were completed, and on testing showed not a single sign of leakage. The huge power house, 185 feet high, was indicated and its proportions brought home to the imagination by the statement that it would obliterate a view of the American falls at Niagara if placed in front. Over 4,830,000 yards of earth and over 2,750,000 yards of rock had to be excavated. Concrete lining at the rate of 2,500 yards a day was laid at an average of two feet thick, and on completion of the work it was found the concrete lining was a month ahead of schedule time. The aggregate weight of plant used was 5,000 tons, which was pulled out of the canal in five days. It included ten concrete plants and five shovels, which alone weighed 4,000 tons.

Mr. Acres, when showing one picture, said that it represented him standing at the foot of a column of water 450 feet weighing five million pounds and travelling at the rate of ten feet a second. Yet it could be brought to rest almost instantaneously. From Chippawa to Queenstown represented a drop of 315 feet.

At the close of the lecture, excellent moving pictures, produced by the Ontario Government Publicity Bureau, gave further illustrations of the magnitude of the task from many standpoints.

Annual Meeting of Canadian Geodetic Society

The fifth annual meeting of the Canadian Geodetic Society was held in Ottawa on the 18th of April, the president Mr. F. A. McDiarmid presiding. Officers elected for the ensuing year were; President, J. L. Rannie; Vice-president, A. M. Grant; Secretary-treasurer, H. G. Rhoades; members of council, J. B. Cannon, J. W. Menzies and F. P. Steers.

The retiring president complimented the society on the high standard maintained in the lectures and discussions during the year, and expressed the thanks of the society to Mr. F. H. Kitto, of the Natural Resources Intelligence Branch, and to Mr. W. C. Way, of the Surveys Laboratory who had delivered lectures during the season.

Edmonton Branch

R. H. Douglas, A.M.E.I.C., Secretary-Treasurer.

The regular monthly meeting of the Branch was held Wednesday April 19th, in the Edmonton Board of Trade Rooms. R. J. Gibb, M.E.I.C., of the city engineers department spoke on "Some Local Items of Municipal Engineering", introducing economies. He dealt briefly on the great difference to-day under which engineering is carried on as compared with ten years ago, and how it was only to be expected that these different conditions should show in the magnitude of public works, and to a lesser extent in quality. He illustrated the point by reference to the local trunk sewer system designed and constructed between 1910-1914, and the construction of the temporary walks in the city to-day, defending both as being justified under the conditions obtaining. He then spoke on the economic design of sewer systems for outlying districts dwelling particularly on the possibilities of the location of intercepters where a choice of location is possible. He also mentioned the tendency towards the construction of the separate sewer system, as against the combined system, due to the high construction costs, and high rates of interest. Mr. Gibb said that whereas such economy can be defended under present financial stress, we should aim to get back to normal working conditions as soon as possible. Mr. Gibb closed his paper by citing a few figures showing how little the city of Edmonton is spending today on maintenance work and operation as compared with the sums spent in the good old times, and hoped that this fact will be taken into consideration when people find condition not just in accordance with their idea of the fitness of things.

J. D. Robertson, A.M.E.I.C., Deputy Minister of Public Works of the Alberta Government gave a very interesting paper on "Road Building in Alberta", dealing with the various problems to be overcome in this province. He pointed out that in the settled portion of Alberta (not including the cities, towns, villages, and hamlets,) there are 166,000 miles of road allowance, 92,000 sections of land and 10,600 resident rate payers. The main highway system constructed and maintained by the Provincial Government covers 3,000 miles of road. The secondary system, or what might be termed main market roads, will total 7,000 miles. Having given the meeting the above facts Mr. Robertson proceeded to develop his subject, and in doing so gave much valuable and enlightening information.

In connection with the British Columbia Professional meeting to be held in Vancouver in June it was decided at the meeting to circularize the various Departmental heads in the Edmonton district pointing out to them the desirability and advantages in having their department as well represented as possible at this meeting.

Arising out of a paper by Clyde Sutherland, A.M.E.I.C., on "Local Concrete Materials," the Branch has appointed a committee of five to further examine our various concret materials, with the idea of arriving at the best combinations obtainable from them; the results and data arrived at to be made available for the Branch. The personnel of the committee appointed was, Clyde Sutherland, A.M.E.I.C., of the city engineer's office, (chairman); R. S. L. Wilson, A.M.E.I.C., of the University of Alberta; T. W. White, A.M.E.I.C., of the Canadian National Railways; S. R. Lamb, A.M.E.I.C., of the E. D. and B.C. Railways and D. W. Ritchie, A.M.E.I.C., of the Highways Branch, Alberta Government.

Quebec Branch

Hector. Cimon, A.M.E.I.C., Secretary-Treasurer.

Problems of the highways formed the central theme of an interesting address delivered on Wednesday evening, April 26th, in the Recorder's Court Room, City Hall, by Alex. Fraser, A.M.E.I.C., of the Provincial Highways Department. This lecture was followed by a remarkable speech on "The Practical Side of Scientific Concrete", by Colonel H. C. Boyden, of the Portland Cement Association, Chicago.

Quebec Highways.

Mr. Fraser dealt interestingly with the practical issues of the problem involved from a two-fold standpoint: (1), The standpoint of the financier and of economics; (2), that of the work itself.

The problem of economics was difficult enough: "I can give no better illustration of this fact," Mr. Fraser said, "than pointing out to the varied systems and laws governing highways throughout the United States and Canada. The differentiations of the laws arose doubtless in the first place from the differentiations in the systems employed, all of which arose very likely from the difference in point of view upon similar problems."

Despite these different points of view, however, and the different systems and laws resulting it was evident, said the speaker, that there was a very marked tendency in one direction. This was on the principle that each one should pay his share toward the expense of making and maintaining highways in proportion of the advantages received. There were the advantages which accrued to the individual and those to the community. The roads formed as a matter of fact a powerful influence upon the entire structure of economic progress of the province. It was evident that the improvements to the greatest highways gave the greatest benefits to the public, therefore the assistance rendered by the government toward the construction of the larger highways must necessarily be greater than upon the smaller ones. The contributions of the individual citizens would naturally be divided between expenses for the local and those for the greater highways. The provincial government would built the large highways and the responsibility for the smaller and local highways would fall upon the municipalities.

Hence one noted the need of classification of routing and of highways. This was in order to appropriate with justice the money required in this connection.

Mr. Fraser described briefly the highways system of Quebec. He finally exposed the chief factors involved in the technical work governing construction and concluded that the highways of Quebec were among the best of their kind to be found anywhere on the continent.

The speaker was warmly applauded by the audience.

Concrete.

Colonel H. C. Boyden, of the enginering staff of the Portland Cement Association, of Chicago, made a most noteworthy speech on "The Practical Sides of Scientific Concrete." Colonel Boyden was not unknown to the members of this branch, for all remembered the practical notes on recent developments in concrete, contributed by him last year. He took opportunity of the lecture of Mr. Fraser to make an historical survey of the highways in the United States. He then reviewed the principal parts of his last year's conference on concrete and he insisted specially on the importance of the water-ratio in the proportioning of ingredients and its influence on the strength of concrete. He also mentioned that in a near future, in construction projects, specifications for concrete will require concrete of a determined strength after a given time. Many questions were brought up to the speaker which have been answered very clearly to the entire satisfaction of all.

A. R. Decary, M.E.I.C., president of the Branch expressed the sentiment of all those present in warmly thanking Colonel Boyden and Mr. Fraser.

Water-powers.

At a luncheon at the Chateau Frontenac, on Monday, May 8th, a most valuable and entertaining paper was read by A. B. Normandin, A.M.E.I.C., who is connected with the Hydraulic Service of the Province of Quebec. Mr. Normandin dwelt upon the usage of water for domestic purposes, navigation and irrigation and incidently upon the value of irrigation in the Provinces of British Columbia and Alberta, in fertilization of the soil for agriculture. He touched upon the immense value of the innumerable Canadian cascades and water resources which give energy for the generation of electricity to satisfy all demands. He discussed at some length the progress made in the employment of the hydraulic resources in the Province of Quebec.

The speaker quoted some statistics giving the available amount of horse-power in Canada and in every province together with their respective amount of horsepower developed. He pointed out that the capital invested in Canada for the utilization of water-powers amounted to $500,000,000. which produced energy equal to 2,762,800 h.p. and a saving of expense in the outlay for steam coal equal to 20,500,000 tons. He also referred to the great benefits derived by industry and commerce from the utilization of water-power for energy and to the water legislation in the province of Quebec.

At the conclusion of the conference the president, Mr. Decary, in the name of the members, thanked Mr. Normandin and congratulated him on his paper.

Saskatchewan Branch

D. A. R. McCannell, A.M.E.I.C., Secretary-Treasurer.

The annual meeting of the Branch was held Tuesday afternoon March 7th, in the Council Chamber, City Hall, Regina.

The following officers were elected: Chairman, J. R. C. Macredie, M.E.I.C., Moose Jaw (Accl); Vice-Chairman, C. W. Dill, M.E.I.C., Regina; Secretary-Treasurer, D. A. R. McCannell, A.M.E.I.C., Regina, (Accl.); Executive Committee, (two years), R.N. Blackburn, M.E.I.C., Regina, Lieut-Col. A. C. Garner, M.E.I.C., Regina, A. P. Linton, A.M.E.I.C., Regina; Nominating Committee: H. R. Mackenzie, A.M.E.I.C., Regina, Convenor, W. A. Begg, A.M.E.I.C., Regina, P. C. Perry, A.M.E.I.C., Regina, Prof. A. R. Greig, M.E.I.C., Saskatoon, Prof. C. J. McKenzie, M.E.I.C., Saskatoon.

There was an interesting discussion in regard to ways and means to make the Branch of more value to non-resident members. It was decided to have at least three papers read before the Saskatoon members before the end of the calendar year and to hold the annual Summer meeting in Moose Jaw early in July. The possibility of furnishing outside member copies of papers upon application to the Branch secretary was also favourably considered.

The Executive committee at their first meeting appointed the following Standing committees: Welfare Committee, J. G. McVean, A.M.E.I.C., Convenor;

Legislation Committee, L. A. Thornton, M.E.I.C., Convenor; Papers and Library Committee, Lieut.-Col. A. C. Garner, M.E.I.C., Convenor; Quarters Committee, D. W. Houston, A.M.E.I.C., Convenor.

The Welfare committe replaces the Salary committee and is entrusted with all matters concerning the promotion of the welfare of the profession as ethics, education, status, protection of engineer's interests and consideration of activities in which the engineer should take an active part. The Papers and Library committee was enlarged and it was recommended that it be divided into three sub-committees, namely; Papers and Library, Publication and Publicity, Recreation and Entertainment. This has been done, and the three sub-convenors being respectively, Lieut-Col. A. E. Garner, M.E.I.C., D. W. Houston, A.M.E.I.C., and H. N. McPherson, A.M.E.I.C. The last named sub-committee has been active as subsequent regular meetings to provide entertainment features during the dinner and previous to the commencement of regular business.

The annual meeting was followed by the annual dinner at the Kitchener hotel from 6.15 p.m. to 8.00 p.m. and a theatre party at the Capitol theatre at 8.00 p.m Ovt-of-town members and ladies were invited as guests of the Regina members. Seventy-five members and friend attended.

On Thursday, March 23rd, a special meeting was held in the Saskatchewan Co-operative Creamery building where six short papers were read and discussed. This proved a very popular meeting. The speakers and subjects were as follows:—

C. H. Biddell, A.M.E.I.C.—"Some Notes on the Location and Construction of Roads by Municipalities".

W. E. Longworthy, Jr., M.E.I.C.—"Notes on the Design and Construction of a Humas Tank."

D. H. Lunam,—"Keeping Accounts."

H. N. Macpherson, A.M.E.I.C.—"Estimating for Construction Work."

T. McGuinness, A.M.E.I.C.—"Notes on Electrolysis Mitigation."

J. H. Puntin, A.M.E.I.C.—"Some Notes on Reinforced Concrete for Building Construction."

On Tuesday, April 18th the regular monthly meeting of the Branch was held at the Kitchener hotel preceded by a dinner at 6.30 p.m.

Lieut-Col. Garner, read a paper on "Saskatchewan and its Natural Resources." The subject matter of his paper was based on two trips made by him into the northern part of the province covering especially the district between Lac La Ronge and the eastern boundary. He pointed out that the proper development of this district would depend on the engineer as transportation and the utilization of the water-powers would be problems to contend with if the various mineral deposits were to be economically worked.

On Thursday May 4th the regular monthly meeting of the Branch was held at the Kitchener hotel preceded by dinner at 6.30 p.m. The Hon. Sam. Latta, Minister of Education and formerly Minister of Highways for the province was our guest and addressed the Branch on road-making and the Government's efforts to build up system of highways throughout the province. The Hon. J. G. Gardiner, present Minister of Highways and H. S. Carpenter, A.M.E.I.C., Deputy Minister of Highways, also spoke on the same subject.

All meetings this past year have been well attended and the discussions following the papers have been very keen showing a healthy interest in the subjects presented.

St. John Branch

Harry F. Bennett, A.M.E.I.C., Secretary-Treasurer.

The St. John Branch closed a very successful year on May 8th, when their annual meeting was held in the Clifton House, at the conclusion of a banquet in the dining hall. Before the business of the meeting was transacted, the chairman, Frank P. Vaughan, M.E.I.C., welcomed the members and their guests to the meeting and regretted that Mayor H. R. McLellan and others had found it impossible to attend.

In replying to the toast to the city of St. John, W. F. Burditt, president of the Board of Trade, expressed his pleasure at being present and dwelt further on the efforts which had been made to rectify the outstanding errors in the lay out of St. John. He had always looked to the engineers for assistance in Town Planning and hoped that they would always be willing to further any scheme for the betterment of the city. C. C. Kirby, M.E.I.C., responding to the toast to the Engineering Profession, urged co-operation and greater efforts to advance the interests of the profession and its members.

The special feature of the evening was an address by Lt.-Col. H. C. Boyden of the Portland Cement Association. He presented very instructive data on the later experiments in the manufacture of concrete and dwelt at length on the benefits accruing from following the system proposed by the Association. At the conclusion of the address numerous questions were asked and a general discussion took place relating to the various problems met in the making of concrete.

The general business of the meeting was then taken up. The membership committee reported considerable change in the membership during the year with a net result of a loss of four members. The employment committee reported a considerable number of applications for work and a portion of these had been assigned to temporary jobs. There were still several engineers unemployed.

The report of the Executive committee showed there had been seven regular meetings, two special meetings and seven visits to works of interest in and about the city during the past year. The finances of the Branch were in good condition with a net surplus of $107.22.

W. J. Johnston, A.M.E.I.C., and J. McM. Lamb, Jr.E.I.C., were appointed scrutineers and reported the election of the following officers:—Chairman, A. G. Tapley A.M.E.I.C.; Secretary-Treasurer, H. F. Bennett, A.M.E.I.C.; Executive Committee, F. G. Goodspeed, M.E.I.C., N. F. Nutter, A.M.E.I.C., G. H. Waring, A.M.E.I.C., (*ex-officio*) F.P. Vaughan, M.E.I.C., C.C. Kirby, M.E.I.C.

The following changes in the By-laws were approved:—

(1) To provide for a vice-chairman, elected annually.

(2) To provide for the filling of vacancies during the year in the Executive committee, by appointment by the Executive committee for the unexpired portion of the Branch year.

(3) To provide for the appointment of a Papers and Meetings committee and the detail of their duties.

Before leaving the chair, Mr. Vaughan thanked the members for their support during the year. He hoped that they would continue to work together and assist the executive in any way possible. He wished the incoming officers every success. Mr. Tapley then took the chair and thanked the members for the honour they bestowed upon him in his election to the chair of the Branch. Mr. Kirby then moved a vote of thanks to the retiring chairman for the very able manner in which he had performed his duties during his term of office, this was seconded by Mr. Bennett who said it had been a pleasure to act as secretary under the guidance of Mr. Vaughan.

The retiring chairman, Mr. Vaughan has since been honoured by the University of New Brunswick at its Encoenial exercises at Fredericton on May 17th, when he was given the degree of M.Sc. (honoris causa) in recognition of his services to the profession and to the university. Mr. Vaughan's many associates and friends extend their hearty congratulations.

The incoming chairman, Mr. Tapley, has been connected with the Dominion Public Works Department since 1909 and is at present assistant engineer in the St. John Harbour office. He was elected a student member of the Canadian Society of Civil Engineers in 1904 and an Associate Member in 1909. He has always taken an active interest in affairs pertaining to the profession.

Hamilton Branch

Opening of Burlington Canal Bascule Bridge.

The Strauss Trunnion Bascule bridge over Burlington channel was officially opened 12th May 1922.

The bridge is 160-foot span — 22-foot roadway — two 9-foot sidewalks — carries one radial railway track and is electrically operated with gasoline engine auxiliary.

Power for operation is obtained from an adjoining railway substation of the Dominion Power and Transmission Company a submarine cable being employed for crossing the channel.

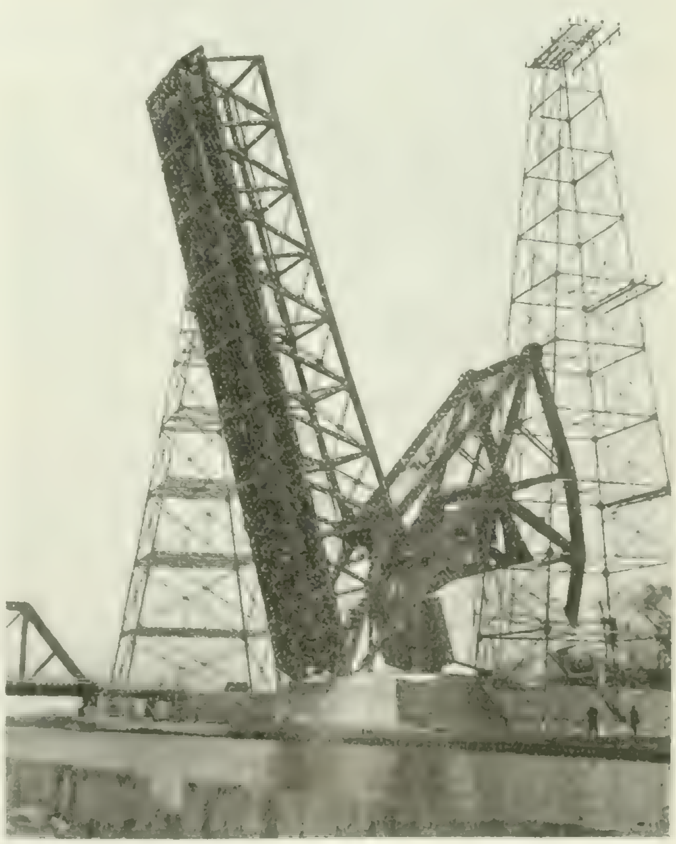
The main motors are, two 48-hp. 550-volt d.c., and are equipped with magnetic brakes: an emergency magnetic brake is also installed. The bridge when closed, is locked and the lock mechanism is operated by a 5-hp. 550-volt d.c. motor. The four roadway gates are also motor operated, ¼-h.p. motors being employed for this purpose.

The control equipment is of the semi-magnetic type and all control circuits are interlocked by means of limit witches and small magnetic contactors to prevent wrong operation; for example: it is impossible to unlock the bridge until the gates are lowered. All control equipment is concentrated on a small control desk at the window from which the operator has a view of road and channel. A mechanical indicator on the wall and illuminated signals on the desk enable the operator to see at a glance the exact position of the bridge at any moment.

A "dead man" foot switch is installed so that should the operator faint, all power would be automatically cut off and all brakes applied.

W. C. Brough, the general assistant engineer of the Department of Public Works, performed the opening ceremony by breaking a bottle, said to contain liquor, over the main trunnion. The cheering died down suddenly when the ancient odour failed to materialize.

The following were present: Dept. of Public Works — Lt.-Col. H. J. Lambe, M.E.I.C. superintending engineer. J. M. Wilson, M.E.I.C., district engineer. Designer — J. B. Strauss, M.E.I.C., Chicago. Harbour Commission — Capt. George Guy. Hydro Electric Power Commission of Ontario — T. U. Fairlie A.M.E.I.C. Hamilton Bridge Works (contractors for the superstructure) — Sir. Jno. S. Hendrie, W. B. Champ, R. K. Palmer, M.E.I.C., and staff. Contractor for the sub-structure — F. W. Paulin, A.M.E.I.C. Dominion Power and Transmission Company — Geo. Waller, superintendent Canadian Westinghouse — (electrical equipment) — George F. Foot.



Burlington Canal Bascule Bridge

The bridge successfully met every test devised by the Department's engineers and by Mr. Strauss who has designed some two hundred structures of this type. The bridge is shown in the accompanying photograph.

Joint Meesing with Ontario Association of Architects

The Branch had a joint meeting with the Hamilton Chapter of the Ontario Association of Architects, at a dinner in the Arcade, at 6.15 p.m. on Tuesday May 16th, 1922. Addresses were given by Mr. Fryer, chairman of the Architects and Mr. Darling for the engineers.

The desirability of co-operation between architects, engineers and contractors was emphasized and a joint meeting with the contractors was advocated. The meeting was enlivened by the singing of choruses and some very good solos were also rendered. About thirty sat down to dinner.

Town Planning Notes and Comments

Horace L. Seymour, A.M.E.I.C.

NOTE. — *In order to make this column of wide interest to members of The Institute, personals and items of town planning interest will be appreciated. Address: Horace L. Seymour, A.M.E.I.C., 40 Jarvis Street, Toronto.*

Third Annual Meeting of the Town Planning Institute of Canada.

"Town Planning may be defined as the scientific and orderly disposition of land and buildings in use and development with a view to obviating congestion and securing economic and social efficiency, health and well-being in urban and rural communities."

Such is the definition of Town Planning that appears in the bylaws of the Town Planning Institute of Canada as proposed in the Charter of Incorporation. Founded in 1919, with an active membership now of nearly 150, the need for incorporation is felt. A draft Charter of Incorporation has been prepared; it has just been approved at the third annual meeting of The Institute it will be submitted to all the members of the Town Planning Institute and will probably be made legal by letters patent, as no opposition to the incorporation is anticipated.

The programme of the third annual meeting was as follows:—

Friday May 12th. Afternoon session, council meeting, registration, and annual business meeting. Evening session, annual dinner, president's address, brief addresses by Mayor Plant of Ottawa; Hon. Rodolphe Lemieux, Speaker of the House of Commons; Senator George W. Fowler, Hon. Member, T.P.I. of C.; announcement of election of officers; and address by J. P. Hynes, A.M.E.I.C., chairman of the Ontario Town Planning and Housing Association, on "Where the Responsibility for Town Planning Belongs"

Saturday May 13th, Morning session, the following papers; Zoning, by Thomas Adams, past president T.P.I. of C.; The Suburban Problem, by W. E. Hobbs, A.M.E.I.C., director of Town Planning, Province of Manitoba; Town Planning Progress in Toronto, by T. D. Le May, city surveyor of Toronto. At the close of the meeting a round table luncheon was served.

The following corporate members of *The Engineering Institute of Canada* were present at one or more of the sessions:-- C. N. Shanly, J. Clark Keith, D. H. Nelles, Noulan Cauchon, H. L. Seymour, Jas. Ewing, N. B. MacRostie, N. J. Ogilvie, H. F. J. Lambart, R. C. Purser, W. H. Norrish, A. A. Dion and Jas. White.

The main item of interest at the business meeting was the discussion of the proposed Charter of Incorporation to which reference has already been made. The absence of Dr. Deville, the president, was keenly felt but he had been called away in the interest of science to Europe. Vice-president Noulan Cauchon, A.M.E.I.C., ably filled his place and gave a splendid review of the work of the Town Planning Institute, and of town planning progress in Canada. Mr. Cauchon has been of great service to the city of Ottawa during the past year as chairman of the Town Planning Commission.

A paper that aroused a great deal of interest and discussion was that entitled "Zoning" by Thomas Adams, past-president of the Town Planning Institute of Canada. Mr. Adams took the actual case of Welland, which is now engaged in the work of town planning. His talk was well illustrated with study maps. The principles of city planning were brought out in a practical way and the relation of zoning to city planning was emphasized. In conformity with the most approved practice in zoning, there has been advocated for Welland "use," "height", and "area", districts all with the same limits. Where such practice is possible it avoids confusion and makes it possible for these zones to be shown all on one map.

Mr. Adams also demonstrated the advisability of making fire limits coincide with use, height and area limits, proving it to be the only rational way for the determination of fire limits. The ability to enforce zoning bylaws under existing legislation was a matter of some discussion. It was felt that it would be a great advantage if some city, such as Welland, would bring the matter before the proper authorities as a test case. The discussion brought out the fact that according to Quebec legislation, cities can be and have been successfully zoned; Westmount and St. Lambert being given as examples.

Town planning education, as usual, was the subject of some discussion. The fact was brought out that severa universities in the States are preparing to grant towr planning degrees for post-graduate courses of two or three years. Some information received with loud applause was to the effect that J. P. Helme, a graduate of the Faculty of Applied Science, University of Toronto, anc a Student Member in the Town Planning Institute o Canada had been granted a scholarship enabling him to travel in Europe and observe town planning feature and points of interest. This scholarship was granted by the Ontario Department of Education through the effort of some of last year's Council of the Town Plannin Institute. A vote of thanks was tendered by the meetin to the Honourable R. H. Grant, Minister of Education

The following officers were elected for 1922: President J. P. Hynes, A.M.E.I.C., Toronto. Mr. Hynes is a prominent architect and president of the Ontario Town Planning and Housing Association. Vice-presidents, Jas Ewing, M.E.I.C., Montreal; W. A. Begg, A.M.E.I.C. Regina; Noulan Cauchon, A.M.E.I.C., Ottawa. Honorar secretary, Major D. H. Nelles, M.E.I.C., Ottawa. Hon orary librarian, W. D. Cromarty, Ottawa. Councillors H. L. Seymour, A.M.E.I.C., Toronto; H. B. Dunningtor Grubb, Toronto; Prof. Percy E. Nobbs, Montreal; W. F Burditt, St. John, N.B.; F. G. Todd, Montreal; Lieu Col. E. T. B. Gilmore, Ottawa; A. A. Dion, M.E.I.C Ottawa; Prof. A. A. Stoughton, Winnipeg; L. C. Charles worth, M.E.I.C., Edmonton; Prof. F. E. Buck, Vancouve

Report of Committee on Policy

Result of the deliberations of the Institute's Committee on Policy at Montreal, April 11th and 12th, as prepared by Chairman J. B. Challies, M.E.I.C., and Secretary A. B. Lambe, A.M.E.I.C. Received by Council May 22nd, and herewith published for the information of the entire membership.

Since the report of the committee on Society Affairs made five years ago, *The Institute* has witnessed a reorganization and rejuvenation far beyond the fondest hopes of the most optimistic of the committee's signatories. Membership and income have grown remarkably, credit balances have replaced annual deficits; and *The Journal*, the frequency and enthusiasm of meetings, annual, general professional and branch, new and virile Branches, increased esprit de corps, remarkable development of class consciousness, all combine to indicate that the committee on Society Affairs builded well and truly.

The increase within recent years in the prestige of the engineering profession is specially due and in generous measure to the service and the sacrifice so conspicuously rendered during the Great War by our members. The Honor Roll in the Main Hall at Headquarters bears eloquent and permanent tribute to one of the main reasons for our present fortunate position in the eyes of the public.

Such progress has resulted in a general desire for a stock-taking looking to a declaration of policy under which the efforts of *The Institute* can be guided in the future. The committee on Policy, therefore, is a natural and inevitable concomitant of the committee on Society Affairs. That committee had to do primarily with reorganization and only incidentally with policy. This committee is concerned more particularly with matters of policy and only incidentally with organization. It is in effect expected to advise Council respecting the appropriateness or otherwise of the objectives of *The Institute*, concerning its policy, and as to any resultant readjustment or reorganization.

The urge for the committee came primarily from the officers of the Ontario Provincial Division, who in their annual report for 1919, suggested the formation of a special committee on Development, to consider and report respecting the technical activities of *The Institute*; its internal relations and local associations; its relations with other national societies and related organizations; its relation to public affairs.

Subsequently the Council of *The Institute*, after a conference with the councillors and certain Branch and Division officers from Ontario, on April 27th, 1920, appointed the following committee on Policy with power to add to its numbers having regard to geographical location,—

J. B. Challies, Ottawa, (Chairman); Gen. C. H. Mitchell, Toronto; K. H. Smith, Halifax; J. G. Sullivan, Winnipeg; A. R. Decary, Quebec; F. H. Peters, Calgary; W. J. Francis, Montreal; A. E. Foreman, Vancouver.

The committee was authorized and instructed to prepare for the consideration of council a statement of the objects and policies of *The Institute*.

A progress report was made to Council in January, 1921, by the Chairman, after consultation by letter with the members of the committee, and was adopted by the annual meeting of *The Institute* held in Toronto on February 3rd, 1921. It appears in the Proceedings of that meeting.

In order to make the committee more representative geographically, Council in March 1921, reconstituted it as follows:—

J. B. Challies, Ottawa, (Chairman); Wills Maclachlan, Toronto; K. H. Smith, Halifax; Gen. C. H. Mitchell, Toronto; C. C. Kirby, St. John; R. O. Wynne-Roberts, Toronto; A. R. Decary, Quebec; J. G. Sullivan, Winnipeg; A. B. Normandin, Quebec; A. J. McPherson, Regina; W. J. Francis, Montreal; K. B. Thornton, Montreal; J. A. Duchastel, Montreal; F. H. Peters, Calgary; A. B. Lambe, Ottawa, (Secretary); A. E. Foreman, Vancouver; W. P. Wilgar, Kingston; W. G. Swan, Vancouver.

At the 1922 annual meeting of *The Institute* in Montreal, the Chairman made a brief, verbal progress report, when he explained the difficulty of composing by correspondence, the conflicting views of the members upon contentious matters under consideration. The annual meeting accepted the verbal report upon the understanding that a plenary meeting of the committee would be called shortly. This plenary meeting was held at Headquarters on April 11th and 12th, with sixteen of the eighteen members in attendance, Four sessions and two informal luncheon conferences afforded opportunities for thorough discussion. It is worthy of record that there was practical unanimity on all important decisions.

To facilitate the committee's work the following material has been prepared by its officers and is of record at Headquarters.—

(a) In May, 1921, a compendium of all available data pertinent to the committee's work and comprising about 150 pages of matter, including, for instance, copies of recent reports from similar committees of other engineering societies;

(b) Precedent to the plenary meeting, an agenda with full explanatory notes, comprising 30 pages of matter, and incorporating some original membership diagrams and summary statements respecting Council attendance and travelling expenses incident thereto;

(c) Complete proceedings of the plenary meeting, comprising 34 pages of closely typed matter, incorporating the formal resolutions and in general the discussions upon which they were based.

The following report of the committee on Policy was prepared from the above, but more particularly from items (b) and (c). It is submitted in its present form in order that the reasons for the committee's deliberations may be understood by, and it is hoped found acceptable to the

members of *The Institute* throughout the Dominion. At any rate the very full presentation herein of the committee's deliberations can form the basis of and facilitate such constructive action as is necessary to make *The Engineering Institute of Canada* a national body of professional engineers, properly constituted to serve the Dominion and the profession to the satisfaction of all classes of engineers in every part of Canada. "Reforms are effective in proportion to their timeliness." The unanimity of the committee is evidence of the timeliness of its conclusions. It is hoped that the general membership will substantially support these conclusions and furnish the requisite support to enable Council to have them implemented without delay.

In brief, the committee on Policy favours,—

(a) **A broadening of The Institute's stated objectives;**

(b) **More effective co-operation with sister bodies in Canada and the United States;**

(c) **A gradual verification of the status of The Institute as the one national, all-embracing, professional organization;**

(d) **Such internal economy changes as will strengthen the Branches and enable them to articulate more directly with the governing body, Council;**

(e) **The making of Council more continuously representative of those centres of Institute activity which do not, on account of distance from Headquarters, function directly;**

(f) **Mileage to Councillors upon a reasonable basis and within the available income of The Institute;**

(g) **More generous and general distribution of the high office of Vice-President, with concurrent extension of its usefulness;**

(h) **Recognition by The Institute of the basic importance of the engineering educational facilities of the Dominion to the future of both the country and the profession;**

(i) **Appropriate action to link up The Institute and its facilities with the students in Engineering in all Canadian institutions of learning;**

(j) **Suitable action to secure adequate academic recognition for the engineering profession comparable to that extended to the sister professions of law and medicine by the governing and degree-conferring bodies of our Canadian universities;**

(k) **An analysis of The Institute's Code of Ethics so that it may be more of a positive influence for a broader and a better professional consciousness;**

(l) **Positive action towards securing just and adequate remuneration for engineers, especially the younger members of the profession.**

Objectives of The Institute.

As a fundamental prerequisite to proper progress is a clear-cut, generally acceptable, comprehensive declaration of the basic purposes of *The Institute*, much time was spent in considering whether the "Objects" of *The Institute* as worded were apt or appropriate, having in mind the recent broadening of *The Institute's* membership, its remarkable increase in late years, and the urgent needs of its various geographical spheres of influence.

The following principal additions were proposed,—

To educate the public to the value of the engineer;

To encourage the study, development and conservation of the natural resources of the Dominion;

To encourage the establishment and maintenance of appropriate educational facilities, academic and otherwise, for the training of engineers.

After a very careful analysis of the above and the present Objectives of *The Institute*, as incorporated in Section 1 of its By-laws, it was unanimously agreed that the Objectives should be broadened and extended. It is accordingly recommended that the Objectives of *The Institute* be formulated as follows,—

(a) To develop and maintain high standards in the engineering profession.

(b) To facilitate the acquirement and the interchange of professional knowledge among its members.

(c) To promote the professional, the social and the economic welfare of its members, as may be deemed necessary for the maintenance of the honor and dignity of the profession.

(d) To enhance the usefulness of the profession to the public, to make known its value, and to indicate means whereby it may be of service.

(e) To encourage the establishment and the maintenance of appropriate educational facilities for the training of engineers.

(f) To promote intercourse between engineers and members of allied professions, and to co-operate with other societies in broadening the usefulness of the profession.

(g) To encourage original research, and the study, development, and conservation of the resources of the Dominion.

Exhibit D, attached, details the aims and objects of *The Institute* and of some of the other leading engineering societies of Great Britain and the United States.

Relationship of Institute to other Cognate Bodies in Canada and in the United States.

The committee is of the view that as in other countries, so in Canada, multiplicity of engineering organizations will not make for efficiency or effective results in efforts to advance the prestige and to promote the usefulness of the engineering profession. The experience of the kindred societies of Great Britain, the United States and of Australia in endeavours to secure conjoint and co-operative action by or on behalf of the engineering profession, indicates that one national, all-embracing, flexible, engineering organization, able to function for all

branches of the profession, whether in national, regional or local affairs, is the ultimate ideal to be achieved.

Leaders of the profession in the United States have been attempting to evolve such an organization by the federation of all the existing professional bodies. Because of traditional differences in policy, of cherished independence and conservatism, of strong sectional consciousness, of regional environment, and because of other limitations inherent in long established bodies, the federation idea in the United States has not proven the panacea for which its sponsors hoped.

So far as Canada is concerned, the same complex conditions do not exist, at any rate only to a very limited extent and regionally. There is but one established national, all-embracing, professional engineering society. There are other cognate societies of importance and promise, and some with both splendid traditions and unique accomplishments to their credit, but none are comparable with *The Institute* in breadth of professional scope, diversity and strength of membership, widespread geographical distribution, or as to flexible organization facilities. Some are organized primarily to advance an industry, as mining, chemistry, or forestry, and embrace a membership a very large proportion of which is neither professional nor engineering. Such bodies have a field of usefulness which should not conflict with the legitimate sphere of *The Engineering Institute of Canada.* On the contrary, the stronger and more progressive such bodies become and the better they function for their own purposes the greater will be the need for *The Institute.*

Still other organizations are of a regional nature, restricted to a particular branch of the profession and consequently limited both in membership and field of operation. These latter include the sections of two of the American Founder Societies which parallel, in most phases of their effort, the activities of the local Branches of *The Institute.*

Propinquity to the United States and its professional engineering practice makes it advantageous for many Canadian engineers to affiliate with one or more of the Founder Societies. A few Canadian engineers also find it advisable to join engineering Institutes of Great Britain and France. The reasons, however, which prompt affiliation with such outside bodies arise largely because of a desire for familiarity with special engineering endeavour abroad and for continuous contact with its best modern practice. Such causes are not incompatible with the privileges and responsibilities of membership in *The Institute.* Indeed affiliation with outside professional bodies should be complementary to and in no sense in conflict with or in substitution for membership in *The Institute.* While the desire for affiliation with outside engineering societies might with propriety be fostered among those Canadian engineers who require such connection, it should, in general, follow rather than precede membership in their national body. If the individual member of *The Institute,* as he progresses in his career, desires additional specialized advantages, he might well seek affiliation with a foreign professional body, but such affiliation should not be at the expense of his support to the national body.

The great bulk of the engineering profession in Canada, — civil, electrical, mechanical, mining, chemical, etc.,— actively supports and strengthens the efforts of the national body for advancing the prestige of the profession and for promoting its usefulness to the public. It should be the aim of *The Institute* not only to welcome into its ranks every worthy professional engineer in the Dominion, but to so mold *The Institute's* objectives, organization and activities that professional engineers of every class will desire membership therein.

The Enginering Institute, as the only national organization of a purely professional engineering nature in Canada, must inevitably occupy a position of leadership in all matters affecting the weal of the engineering profession in the Dominion. Great responsibility is therefore placed upon *The Institute.* It must be ready, willing and competent to function properly. If *The Institute* is functioning properly, it is not apparent why the establishment in the Dominion of further branches or sections of outside societies is advisable or necessary. At the same time, when such branches are established, the most cordial co-operation should be extended by *The Institute* whenever and wherever possible.

Leadership, not domination, is the logical role of *The Institute.* All activities to achieve the objectives of *The Institute,* whether directed by Council, Provincial Divisions, or Branches, should be premised upon a broad, generous and positive policy of co-operation with cognate societies. This is particularly advisable where opportunities are offered for collaboration with other engineering societies, or with Canadian sections of the American Founder Societies. Especially should frank, free and friendly co-operation be sought and maintained with the Canadian Institute of Mining and Metallurgy, a body with a long and honourable record on the pages of professional and industrial history in Canada.

Apart from a brief, general positive declaration of policy consistent with the above, and as an earnest of the fraternal good-will and sincere desire of *The Engineering Institute of Canada* for the general advantage of the engineering profession, the committee recommends that Council should take such steps both within *The Institute* and in relation to other engineering bodies in Canada and the United States, as will produce (a) a better understanding and more generous appreciation of each other's objectives and relative spheres of activity, and (b) friendly co-operation or united action in professional endeavour.

It was further unanimously recommended that Council prosecute through the committee on International Relationship or otherwise a policy of as intimate, friendly relationship and fraternal co-operation with the Founder Societies and others similarly constituted in the United States as conditions will permit.

Organization within The Institute.

So far as organization is concerned, the committee was of the opinion that the transition from the period of the Canadian Society of Civil Engineers provoked constitutional changes of an epochal nature. They have been largely devolutionary; the pendulum has swung from Council domination of all business and consequently of policy, to the present regime of "home rule" or self-determination of Branches and Provincial Divisions.

Council's time is now taken up almost exclusively with matters of general concern. There is now ample provision through Branches and Provincial Divisions for local freedom of action and initiative. Further devolution is not considered necessary or advisable. Too much devolution may mean ultimate disintegration. There is, however, need for betterment and changes in certain internal economy matters.

The committee therefore favoured the attachment of every member to a Branch, except that members non-resident in Canada should be automatically attached to Headquarters unless they elect to become Branch members and designate the Branch they desire to join, which right of election and designation should be conferred upon them. It was of course understood that such changes would not involve increases in fees to the present non-resident class of membership.

Membership Nomenclature.

The committee gave extended consideration to proposals for the simplification of membership grades and recommends,—

(a) That the name of the grade "Associate" be changed to "Affiliate" with the same qualifications as at present;

(b) That the names, qualifications and age limits of the other grades be left as they are;

(c) That both the entrance fee and the annual fees of the Associates of *The Institute* (Affiliates) be $10 instead of the present fees of $15 entrance and $13 annual.

(d) That the By-laws of *The Institute* be amended so as to provide that Juniors be given the right to vote in branch elections and to hold any Branch office with the exception of that of Chairman and Vice-Chairman, but that no change be made in the By-laws with regard to Associates.

Council—its Number and Representation.

The opinion was expressed that Council, as at present constituted, was too large; that representation by a definite working unit such as a Branch, instead of through the present inchoate, more or less arbitrary electoral districts, would make it a more effective body.

The committee is of the opinion that Council is too large a body and if reduced its efficiency would be increased and its expenses reduced. That Council is unduly large is very strikingly shown by a schedule, exhibit A, detailing the governing bodies and members of some fourteen engineering societies of Great Britain, Canada and the United States. An average of six of the more prominent shows that they have but one councillor for every 336 members and an average total Council of 27. *The Institute,* however, has a Councillor for every 81 of its membership and a total Council of 41. It would appear that *The Institute's* governing body might well be reconstituted and its membership reduced.

The matter of electoral districts was given consideration and the committee feels that the unit of representation should be the Branch. It is recognized that in certain cases this would be a fairly small unit. Especially would it be small in the case of some of the newer Branches. If every Branch were given representation the number of Councillors would not be reduced to any appreciable extent, and indeed the creation of new Branches would tend to continually enlarge the Council. Nevertheless it is the unanimous opinion of the committee that the Branch is, with suitable limitations as to smaller and newer Branches, the proper electoral unit.

The committee would stress the importance of according Branches a direct representation upon Council because it affords that more intimate connection between the governing body of *The Institute* and its main factors so necessary for progress. Furthermore, such action would be consistent with the tendency in recent years to afford Branches an ever-increasing measure of home rule, and consequently a greater voice in determining the policy and in guiding the activities of *The Institute.*

The committee recommends that Council take the necessary steps to ensure that all Branches be represented on Council.

Vice-Presidential Representation

The Constitution quite properly requires that there shall always be a Headquarters' Vice-President. At best this means that three of the four Vice-Presidents may be non-residents of Montreal. In practice, however, it quite often occurs, and it is so at the present time, that the Vice-Presidents are equally divided between Headquarters and outisde. Obviously this is not an equitable arrangement for the non-resident members,—two Vice-Presidents for a Headquarters corporate membership of 900 and two for a non-Headquarters corporate membership of 2,500.

If the Vice-Presidents were chosen as now, for a two-year term, but from residents of the major zones of *The Institute,* as for instance, the Maritime Provinces, the Province of Quebec, the Province of Ontario and the western provinces, there would be a more equal and acceptable apportionment of this high office. Such an arrangement would make for better geographical representation upon Council. They might be given the special duty, under the direction of the President and with the co-operation of the General Secretary, of visiting each Branch at least once a year. It should not be a difficult matter for a Vice-President of a zone to see that every Branch in his zone is visited at least once a year. Further exchange visits among Vice-Presidents for different zones would make for broader concepts of Institute objectives and policy, as well as a better understanding of its activities. The committee recommends that the number of Vice-Presidents be increased and that they be elected by their repective zones. Exhibit B, attached, shows in diagrammatic form a suggested re-arrangement of Vice-Presidential distribution that it is hoped will be acceptable to the membership.

Meetings of Council at Different Centres of Institute Activity

The present practice of holding practically all the meetings of Council at Headquarters is not conducive to a thorough understanding of certain local and sectional conditions which must inevitably have an important and in certain cases, dominant bearing upon the affairs of *The Institute,* as well as on the prestige of the whole profession

There is no constitutional impediment to Council holding meetings concurrent with general professional meetings. It might also be advantageous if Council held at the most suitable time once a year, what might be called "zone meetings." For instance, it should be possible for the President or a Vice-President, with the General Secretary, to convene a meeting in the Maritime Provinces of all Councillors within that zone; a similar meeting might be held in Ontario and in western Canada. Such zone meetings need not be plenary conferences of all members of Council, but the attendance of those members within geographical zones where they are held should be stressed and their expenses paid.

To prevent important decisions of general import to the profession and to *The Institute* being taken under what might be considered undue local influence and without proper general prospective, actions involving decisions at such zone meetings might be subject to subsequent ratification either by letter ballot, of all members, or at a regular Headquarters meeting.

A schedule, exhibit C, showing the attendance upon Council meetings for the past two years indicates the infrequency of adequate representation for a large majority of outside districts.

The committee, however, makes no specific pronouncement on the matter of Council meetings away from Headquarters, understanding that Council has the power to accommodate its place of meeting to the needs of *The Institute.* Furthermore, Council has upon occasion met at outside points, for instance, Toronto and Saskatchewan, and will doubtless be glad to do so again.

Mileage to Councillors

If Council is to be representative of the whole Dominion and able to function more effectively for all parts and classes of *The Institute* membership, something must be done to ensure a better attendance of outside members. Unless the attendance of far away councillors can be brought about, the growth and development of *The Institute's* activities outside of Montreal and the districts contiguous thereto (Ottawa and Quebec) must proceed without the advantage of Council's supervision.

Further, rivalry within recent years between Headquarters and outside membership of the governing bodies of certain of the Founder Societies of the United States has produced a situation which might, under conceivable circumstances, be paralleled within *The Institute*, unless the presence of more outside members of Council can be assured. Such assurance can be partially, if not absolutely, secured by *The Institute* agreeing to pay, within reasonable limitations, the expenses of its Councillors. One thing certain, the adoption of such a policy would disarm any criticism of the alleged control of Council by Headquarters and near-by members, even though, in the future, but a few additional outside members should find it possible to attend Council meetings.

To pay the travelling expenses of all members to every meeting would of course be the best possible arrangement, but this would involve an outlay obviously far beyond *The Institute's* powers. It should be possible however to pay the expenses of each Councillor to one meeting per year, which would involve an annual outlay of about $3,000.

The committee is unanimously of the opinion that contributions towards councillors' expenses, in whole or in part, is undoubtedly the next matter to which *The Institute* should devote any funds not otherwise appropriated. The committee recommends that for the present arrangements be made to pay the expenses of councillors to one Council meeting per year, and suggests that this be a plenary meeting.

Engineering Education and Student Activities.

Probably one of the most far-reaching and portentous matters considered by the committee was the fundamentally important question of the relationship of *The Institute* to the education of engineers to meet the needs of the Dominion, and how best *The Institute* could participate in student activities.

To-day the future engineer is an engineering student. Underlying the whole engineering structure lies the training of that student. What preparation should he have, what knowledge, what training, what vision, what purpose? How can he be taught, developed and inspired?

Two matters have been quite lost sight of by *The Institute* to date,—

(a) the fundamentally important question of appropriate educational facilities for those desiring to enter the engineering profession; and

(b) the relationship of the under-graduate student body to *The Institute.*

The individual engineer can expect only such public and private recognition and advancement as his training, education, fitness and personality may warrant. It behooves *The Institute*, therefore, to encourage the establishment and to assist in the maintenance of educational courses covering in addition to sound training in the sciences and fundamentals of diversified engineering, training in the human arts and sciences, including for example, political science, economics, history and general letters. Indeed the engineering profession cannot afford to be any less thoroughly qualified by education or otherwise than are the sister professions of law and medicine. Both of these professions have now collegiate courses ranging from six to seven years. It is not suggested that existing engineering courses should be extended. It might, however, be pointed out that every year sees the percentage of university trained engineers in practice increasing. If the bulk of our membership is to be of this class in the future, *The Institute* must forsake its attitude of laissez faire towards professional educational facilities, and assume some responsibility in shaping these courses to meet the changing needs of the times.

The generous recognition by the universities of McGill, Queen's and Toronto, in including engineers in their list of recipients of honorary degrees is both an evidence of the growing appreciation of the profession and an indication of the close relationship between higher education and the engineer.

For other faculties and professions there is a well-defined course leading to doctorate degrees. Why should there not be an appropriate degree in engineering compar-

ble to the LL.D., the Ph.D., the D.Sc., and the D. Ped. Would not the establishment of a degree "D.Eng." (Doctor of Engineering) to be conferred both *honoris causa* and *pro merito*, be a fitting academic recognition of the status of the engineering profession? Action necessary to have our universities establish such a degree might be considered and recommended by an Institute committee.

The diversity in university degrees in Applied Science and Engineering is a matter worthy of study by *The Institute*, also whether it would not be more appropriate if engineering rather than science were stressed in the nomenclature of these degrees.

Closely allied to the consideration of appropriate curricula for engineering education, is the question of the relationship of *The Institute* to its Student class. During recent years a remarkable interest has been engendered among the under-graduate bodies of our larger universities in *The Institute*. For instance, there are now about 200 Student members at the University of Toronto; 300 at McGill University, and 70 at Queen's University. This situation presents a problem to *The Institute* which demands its best consideration. As it involves basic issues of far-reaching importance, it should receive the continuous attention of a competent and specially chosen committee.

The future of the profession depends very largely upon the Student membership of *The Institute*. Engineering students cannot be too soon brought into intimate contact with the objects, the policy and the activities of *The Institute*. The American Founder Societies have achieved splendid results in furthering the interest of their Student members. *The Engineering Institute* can well profit by such experience. The committee therefore unanimously recommends the appointment of a special committee of Council to consider the matter of engineering education and student activities.

Code of Ethics.

The Code of Ethics of *The Institute* represents the policy or purpose which should actuate its individual members in their professional relationship to the public and toward one another. Inhibitions expressed therein are unfortunately violated and occasionally Council is called upon to act, or at any rate to make appropriate rulings in cases where violations are brought to its official attention. Rarely, however, is information respecting such cases made available to the general membership. The committee recommends that Council appoint a special committee to examine the Code of Ethics of *The Institute*, to compare it with those of other societies, and to recommend any changes it may think desirable, further, that such committee be authorized and instructed to confer with the various Branches in the course of its deliberations.

Financing of Provincial Divisions.

As no provision is made in the present Constitution for financing Provincial Divisions, the committee's opinion on the question was requested by Council.

The committee's conclusion is that the Provincial Division is an advantageous part of *The Institute's* organization, but as the activities thereof and the benefits therefrom must of necessity be confined very largely to a provincial territory, a share of *The Institute* funds as a whole should not as a regular and an accepted practice be assigned thereto.

The committee therefore could not see its way clear to recommend any change in the present procedure, viz., that Provincial Divisions obtain requisite funds either by assessing the members in their jurisdictions or through contributions from the Branches concerned.

Relationship of the Headquarters (Montreal) Branch to The Institute.

As there have been misunderstandings concerning the relationship of the Headquarters Branch to *The Institute*, especially among the far-away members, the committee devoted some time to the consideration of this question. It was represented to the Committee that the idea has been current at times that the Montreal Branch enjoys certain privileges not available to the rest of *The Institute*, and for which its members make no adequate return. After careful consideration the committee takes pleasure in reporting that this impression is not warranted and that as a matter of fact the debit balance is actually against *The Institute*, in that the Montreal members are not only devoting much time and thought to *The Institute* and its work but are in addition paying large extra fees. For instance, a statement laid before the committee showed that during the year 1921 *The Institute* received about $1,050.00 net from the Montreal membership over and above what it would have received from the same members if they had been paying the same fees as ordinary branch residents. If this be considered as a return for the use made of the Headquarters building by the Montreal Branch, it is obviously a large rental for any Branch to pay for its meeting rooms. In addition, there must always be remembered the work done year after year for *The Institute* by the Montreal Councillors.

The committee desires to record its appreciation of the fact that there are no undue advantages accruing to the Montreal Branch, financially or otherwise, by reason of its location at Headquarters.

Proposals for a Plenary Meeting Annually of Branch Secretaries.

This very important question was, by special reference from Council, considered by the committee. It was discussed at length, but on the whole the sense of the members of the committee was against such meetings. This decision was reached to a large degree because of the feeling that if there were matters requiring discussion by a body other than Council that the proper organization to handle them would be a special committee consisting either of representatives appointed specially by the Branches or else of the Branch Chairmen.

Another factor that influenced the committee was the universal feeling that the payment of councillors' expenses, in part or in whole, was the next matter to which any spare funds of *The Institute* should be devoted. Further, it was thought that if Council carried out the recommendation already made to arrange for Branch representation on Council that that would give Branches

somewhat greater facilities than at present for any needed inter-discussion of their respective problems.

It was generally admitted that secretaries' meetings would help towards the standardization of such matters as the keeping of Branch records, the handling of Branch correspondence, the procedure at meetings, etc., etc., but it was thought that as far as such standardization was advisable that it could be handled to advantage through the general office, either by correspondence or through the annual visits now being made by the General Secretary to each Branch. At the same time the meeting did not lose sight of the invaluable work being done for *The Institute* by Branch secretaries, and much appreciation for their activities was expressed. It was generally agreed that Branches should be urged to facilitate the attendance of their respective secretaries at every annual meeting.

In view of the decision of the committee to recommend that all Branches should be represented on Council, and also that the expenses of Councillors should be paid to one meeting per year, the committee is of the opinion that the idea of yearly plenary meetings of secretaries should not be endorsed. The committee, however, strongly recommends that attention of Branches be specifically called to the importance of the attendance of their secretaries at annual meetings.

Remuneration and Classification

This important question which has been occupying the attention of organized engineering bodies on this continent during recent years, has, the committee understands, been effectively dealt with as far as *The Institute* is concerned, by a special committee appointed by Council in March 1920.

The Policy committee is strongly of the view that this committee's report should be referred to every Branch Executive committee for study and report; that upon the receipt of their replies the special committee be requested to consider same and again report to Council; that then and before anything is made public, Council take appropriate steps to secure from sister engineering bodies in Canada their opinions of the committee's report and recommendations. After such bodies have been conferred with, but not before the committee's report should be published in *The Journal* for the general information of its members.

The committee on Policy is strongly in favour of *The Institute* doing everything possible to secure the promulgation, the adoption and the enforcement of adequate salary schedules.

Branch Resolutions upon Public Questions.

The committee has considered, by correspondence, the question referred to it as to the most desirable procedure with regard to resolutions passed by different Branches on matters of more than local interests, and after careful consideration of the various phases of the matter begs to say that, while quite recognizing the *right* of Branches to formulate and announce their individual opinions, and expressing the hope that Branches will continue to take into consideration the public engineering and allied questions that are current in their respective territories, the committee nevertheless is of the opinion that it is undesirable for Branch resolutions on matters of other than purely local interest to be made public before such resolutions be passed on to Council for its consideration, and Council's recommendation as to their public formulation be obtained.

This recommendation is based very largely on the fact that, notwithstanding that every care be taken to ensure that Branch opinions be published as such and not as Institute decisions, it is impossible to make the general public appreciate the distinction, and consequently it is but a very short time before each such opinion is quoted as and considered to be the opinion of *The Institute* as a whole. But in many instances the opinions of different Branches may be diametrically opposite to each other, with consequent endless chances for contradiction and confusion. From this it follows that it is obviously anything but good procedure that such opinions be publicly announced before submission to the collective consideration of the membership as represented by Council.

Further, the committee would also recommend that whether or no its above suggestion be approved of as to communicating with Council before the publication of Branch resolutions, that, in the case of resolutions intended for transmission to any government or governmental bureau, the practice be established of forwarding these always and only through Council.

In conclusion, the Policy committee desires to record its appreciation of the very great value of *The Journal* to *The Institute.* The committee would also record its appreciation for the advice and assistance rendered throughout its work by the General Secretary.

On behalf of the committee,

J. B. Challies,
Chairman.
A. B. Lambe,
Secretary.

EXHIBIT A.—Comparison of the Systems of Governing Control Adopted by the Leading Engineering Societies.

	1	2	3	4 Present	5 Proposed	6	7
Name	E.I.C.	Am. Soc. C.E.	Am. Inst. E.E.	Am. Soc. Mech.E.	Am. Soc. Mech. E.	Am. Ins. Min. & Met.	Am. Assn. E.
Voting Membership	3306x	9268x	12,200x	10,840x	14,455x	8266x	16,000x
Governing Body	Ccuncil	Board of Direction	Board of Directors	Council	Council	Board of Directors	Board of Directors
Comprises	President 3 Past " 4 Vice " 33 Councillors	President 5 Past " 4 Vice " 18 Directors Secretary Treasurer	President 2 Junior Past Presidents 10 Vice " (1 from each geographical district) 12 Managers Treasurer	President 5 Past " 6 Vice " 9 Managers Treasurer	President 3 Past " 3 Vice " 14 Councillors Treasurer	President 2 Past " 6 Vice " 15 Directors	President 2 Vice " 13 Directors
Total	41	30	26	22	22	24	16
Members per officer	81	307	470	493	657	344	1000
Electoral Districts	10 for Ccuncillors. President and Vice-Presidents elected at large x as at Jan. 1, 1922.	Officers elected at large except the Secretary. 13 geographical districts to secure regional representation. x as at Jan. 1, 1922	Directors elected at large. Nominations are made by entire membership. x as at Jan. 1, 1921.	Officers elected at large, selected so as to secure geographical representation. x as at Sept.1921.	Officers elected at large, so as to secure geographical representation. x Under the proposed constitution Juniors will have a vote.	Officers elected at large. Nominations to represent 13 geographical districts. x as at Jan. 1, 1921	x Estimated

	8	9	10	11	12	13	14
Name	West. Soc. of Eng.	Eng. Soc. of Western Penn.	Inst. C.E.	Inst. E.E.	Inst. of Mech. E.	Inst. of Chemistry	Inst. of Eng. & Ship Builders in Scotland
Voting Membership	1124x	1250x	8040x	5830x	5678x	3420x	1515x
Governing Body	Board of Direction	Board of Directors	Council	Council	Council	Council	Council
Comprises	President 3 Past " 3 Vice " 3 Trustees Treasurer 3 Chairmen of the Sections	President 2 Vice " 8 Directors 3 Chairmen of Sections Secretary Treasurer	President 4 Vice " 30 Councillors	President 4 Vice " 18 Councillors Treasurer	President All Past Presidents 6 Vice Presidents 21 Councillors	President 6 Vice " 35 Councillors	President All Past Presidents. 6 Vice Presidents. 18 Councillors
Total	14	16	35	24	35	42	32
Members per Officer	80	78	230	243	162	81	47
Electoral Districts	Officers elected at large x in year 1919.	Officers elected at large. x in year 1919.	Officers elected at large. x as at Jan.1,1920.	Officers elected at large. x as at Oct. 1919.	Officers elected at large. x in year 1916.	Officers elected at large. x in year 1921.	Officers elected at large. x in year 1920

EXHIBIT "B".

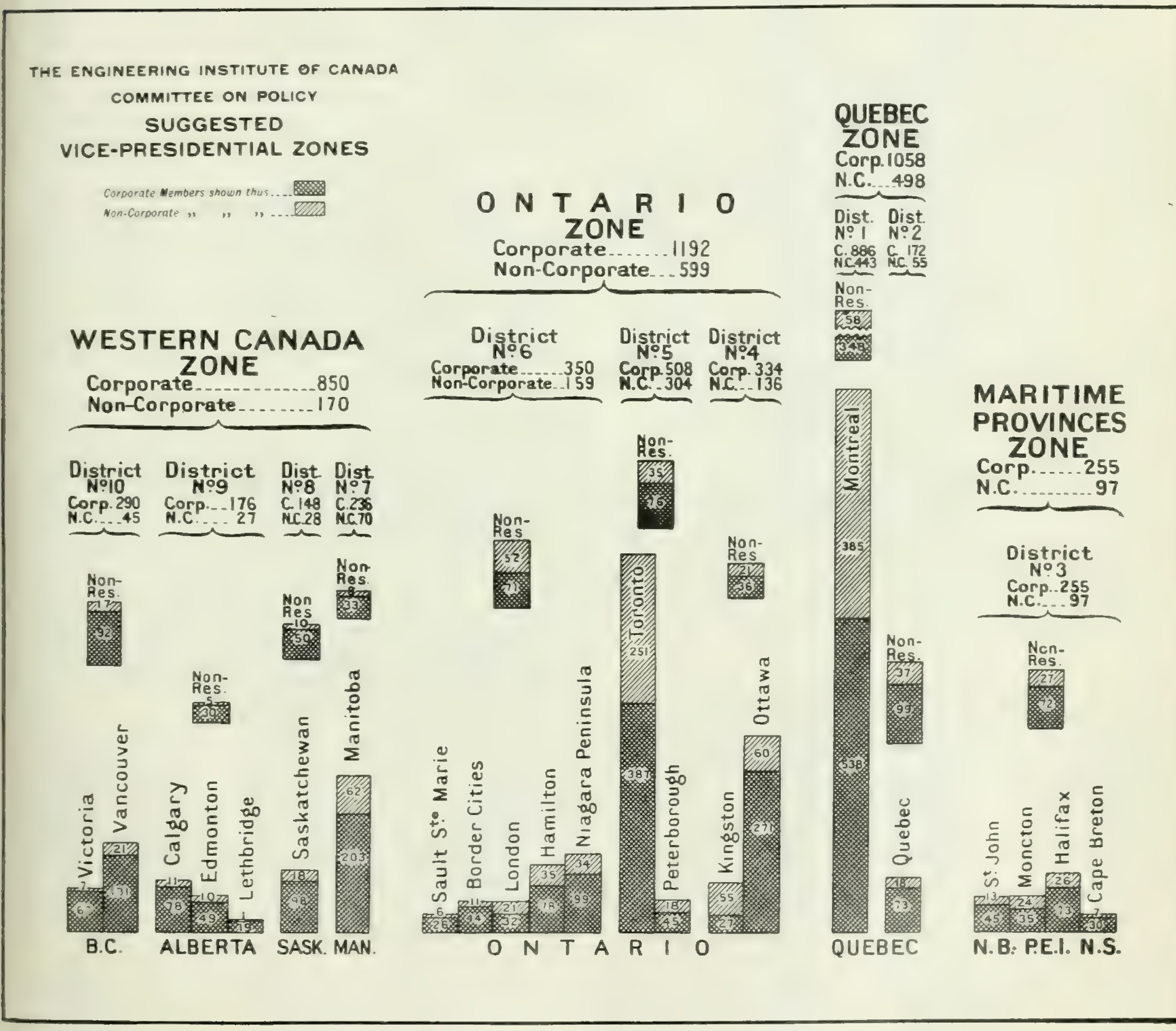

THE ENGINEERING INSTITUTE OF CANADA
COMMITTEE ON POLICY
SUGGESTED
VICE-PRESIDENTIAL ZONES
Corporate Members shown thus
Non-Corporate " " "
WESTERN CANADA ZONE
Corporate 850
Non-Corporate 170
District No. 10
Corp. 290
N.C. 45
District No. 9
Corp. 176
N.C. 27
Dist. No. 8
C. 148
N.C. 28
Dist. No. 7
C. 236
N.C. 70
ONTARIO ZONE
Corporate 1192
Non-Corporate 599
District No. 6
Corporate 350
Non-Corporate 159
District No. 5
Corp. 508
N.C. 304
District No. 4
Corp. 334
N.C. 136
QUEBEC ZONE
Corp. 1058
N.C. 498
Dist. No. 1
C. 886
N.C. 443
Dist. No. 2
C. 172
N.C. 55
MARITIME PROVINCES ZONE
Corp. 255
N.C. 97
District No. 3
Corp. 255
N.C. 97
Non-Res.
Victoria
Vancouver
Calgary
Edmonton
Lethbridge
Saskatchewan
Manitoba
Sault Ste Marie
Border Cities
London
Hamilton
Niagara Peninsula
Toronto
Peterborough
Kingston
Ottawa
Montreal
Quebec
St John
Moncton
Halifax
Cape Breton
B.C.
ALBERTA
SASK.
MAN.
ONTARIO
QUEBEC
N.B.
P.E.I.
N.S.

EXHIBIT "C".

COUNCIL ATTENDANCE 1920.

Councillor	Branch or Residence	Dist.	Meetings: Feb.17, Mont.	March23, Mont.	April 27 Mont.	May 3, Mont.	May 18, Mont.	May 26, Mont.	June 22, Mont.	July 20, Mont.	Aug.24, Mont.	Sept.30, Mont.	Oct.26, Mont.	Nov.30, Mont.	Dec. 21, Mont.
A. B.	Montreal	Pres.		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
B. C.	Winnipeg	V.Pres.							✓						
C. D.	Toronto	Do.					✓								
D. E.	Montreal	Do.	✓		✓	✓	✓	✓		✓					
E. F.	Victoria	Do.													
F. G.	Montreal	PastPres.													
G. H.	Do.	Do.		✓	✓		✓					✓		✓	✓
H. I.	St.Catharines	Do.													
I. J.	Montreal	1	✓	✓	✓		✓	✓			✓		✓		
J. K.	Do.	1	✓	✓	✓	✓						✓	✓	✓	✓
K. L.	Do.	1	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
L. M.	Do.	1					✓	✓			✓	✓			✓
M. N.	Do.	1								✓			✓		
N. O.	Do.	1	✓			✓			✓	✓	✓			✓	✓
O. P.	Sherbrooke	2													
P. Q.	Quebec	2	✓	✓	✓		✓		✓						
Q. R.	Do.	2													
R. S.	Halifax	3							✓						
S. T.	St. John	3													
T. U.	New Glasgow	3													
U. V.	Ottawa	4	✓	✓					✓	✓					
V. W.	Hull	4		✓	✓								✓		
W. X.	Ottawa	4			✓						✓				
X. Y.	Toronto	5													
Y. Z.	Hamilton	5													
B. A.	Toronto	5													
C. B.	Winnipeg	6													
D. C.	Do.	6													
E. D.	Do.	6										✓			
F. E.	Moose Jaw	7													
G. F.	Do	7													
H. G.	Regina	7													
I. H.	Calgary	8													
J. I	Edmonton	8													
K. J.	Calgary	8													
L. K.	Vancouver	9													
M. L.	Victoria	9													
N. M.	Vancouver	9													
Number of Districts Represented			3	3	3	1	3	1	4	2	2	1	3	1	1
Number of Districts Unrepresented			6	6	6	8	6	8	5	7	7	8	6	8	8
Percent of Districts Unrepresented			67	67	67	89	67	89	56	78	78	89	67	89	89
Average Percent of Districts Unrepresented			76												

COUNCIL ATTENDANCE 1921.

Councillor	Branch or Residence	Dist.	Meetings: Jan. 4, Mont.	Jan. 25, Mont.	Feb. 3, Toro.	Feb. 22, Mont.	March 22 Mont.	May 17, Mont.	June 21, Mont.	Aug. 12, Sask.	Aug. 26, Mont.	Sept.20, Mont.	Nov. 22, Mont.	Dec. 20, Mont.
A. B.	Montreal	Pres.			✓	✓	✓	✓	✓		✓	✓		✓
B. C.	Winnipeg	V. Pres.												
C. D.	Toronto	Do.												
D. E.	Montreal	Do.					✓		✓		✓	✓	✓	✓
E. F.	Niagara Falls	Do.												
F. G.	Montreal	PastPres.						✓						
G. H.	St.Catharines	Do.												
H. I.	Montreal	Do.	✓	✓	✓	✓	✓		✓				✓	
I. J.	Montreal	1	✓			✓	✓		✓					✓
J. K.	Do.	1	✓	✓	✓	✓			✓		✓	✓		✓
K. L.	Do.	1				✓	✓	✓					✓	✓
L. M.	Do.	1	✓					✓				✓	✓	
M. N.	Do.	1				✓	✓				✓	✓		
N. O.	Do.	1				✓	✓	✓	✓		✓	✓		✓
O. P.	Quebec	2		✓		✓	✓	✓	✓			✓	✓	✓
P. Q.	Do.	2												
Q. R.	Do.	2												
R. S.	Halifax	3						✓						
S. T.	St. John	3			✓									
T. U.	Do.	3				✓			✓					
U. V.	Ottawa	4				✓		✓	✓					
V. W.	Do.	4			✓		✓							
W. X.	Hull	4			✓		✓					✓		
X. Y.	Peterborough	5			✓									
Y. Z.	Toronto	5												
B. A.	Do.	5			✓									
C. B.	Niagara Falls	6			✓									
D. C.	Windsor	6												
E. D.	Hamilton	6												
F. E.	Winnipeg	7								✓				
G. F.	Do.	7												
H. G.	Do.	7								✓				
I. H.	Regina	8												
J. I.	Moose Jaw	8								✓				
K. J.	Do.	8								✓				
L. K.	Calgary	9								✓				
M. L.	Edmonton	9												
N. M.	Lethbridge	9								✓				
O. N.	Vancouver	10												
P. O.	Armstrong, B. C.	10												
Q. P.	Vancouver	10								✓				
Number of Districts Represented			1	2	6	4	3	4	4	4	1	3	2	2
Number of Districts Unrepresented			9	8	4	6	7	6	6	6	9	7	8	8
Percent of Districts Unrepresented			90	80	40	60	70	60	60	60	90	70	80	80
Average Percent of Districts Unrepresented			70											

EXHIBIT "D"

The Aims of the Leading Engineering Societies as Defined in their Constitutions or Bylaws.

1. **The Engineering Institute of Canada.**

The objects of this Institute shall be (a) to facilitate the acquirement and interchange of professional knowledge among its members, (b) to promote their professional interests, (c) to encourage original research, (d) to develop and maintain high standards in the engineering profession, and (e) to enhance the usefulness of the profession to the public.

2. **American Society of Civil Engineers.**

Its object shall be the advancement of engineering knowledge and practice and the maintenance of a high professional standard among its members.

3. **American Institute of Electrical Engineers.**

Its objects shall be the advancement of the theory and practice of Electrical Engineering and of the allied Arts and Sciences and the maintenance of a high professional standing among its members. Among the means to this end shall be the holding of meetings for the reading and discussion of professional papers and the publication of such papers, discussions and communications as may seem expedient.

4. **American Society of Mechanical Engineers.**

To promote the arts and sciences connected with engineering and mechanical construction.

5. **American Society of Mechanical Engineers, as Proposed in New Constitution.**

The objects of this Society are to promote the arts and sciences connected with engineering and mechanical construction, to promote intercourse among engineers and between them and allied technologists, and to co-operate with other societies in broadening the civic usefulness and advancing the standing of the engineering profession.

6. **American Institute of Mining and Metallurgical Engineers.**

That the American Institute of Mining Engineers is an unincorporated association organized and existing with the object of promoting the arts and sciences connected with the economic production of the useful minerals and metals and the welfare of those employed in these industries by means of meetings for social intercourse and the reading and discussion of professional papers, and to circulate by means of publications among its members and associates the information thus obtained.

7. **American Association of Engineers.**

The objects of the Association shall be to raise the standards of ethics of the engineering profession and to promote the economic and social welfare of engineers, especially by;

Affording means for the interchange of information beneficial to members of the engineering profession, maintaining a service clearing house for the benefit of members, influencing proposed legislation affecting the engineering profession and taking action necessary or advisable to safeguard the profession's welfare, promulgating the Association's ideas through proper publicity, and fostering a brotherly spirit among members.

8. **Western Society of Engineers.**

The object of this Society shall be the advancement of the science of engineering, and the best interests of the profession.

9. **Engineering Society of Western Penn.** No information.

10. **The Institution of Civil Engineers.**

Was first established, and has since been incorporated by Royal Charter, for the General Advancement of Mechanical Science, and more particularly for promoting the acquisition of that species of knowledge which constitutes the profession of a Civil Engineer; being the art of directing the great source of power in Nature for the use and convenience of man, as the means of production and of traffic in States both for external and internal trades, as applied in the construction of roads, bridges, aqueducts, canals, river navigation and docks, for internal intercourse and exchange; and in the construction of ports, harbours, molés, breakwaters and light-houses, and in the art of navigation by artificial power for the purposes of commerce; and in the construction and adaptation of machinery; and in the drainage of cities and towns.

11. **The Institution of Electrical Engineers.**

To promote the general advancement of Electrical and Telegraphic Science and its applications, and to facilitate the exchange of information and ideas on these subjects by means of meetings, exhibitions, publications, the establishment of libraries, the giving of financial assistance to inventors and experimenters, the provision of buildings for carrying on business of the Institution, and finally any lawful deed conducive to the attainment of its objects.

12. **Institution of Mechanical Engineers. (England).**

(a) To promote the science and practice of Mechanical Engineering and all branches of mechanical construction, and to give an impulse to inventions likely to be useful to the Members of the Institution and to the community at large.

(b) To enable Mechanical Engineers to meet and to correspond, and to facilitate the interchange of ideas respecting improvements in the various branches of mechanical science, and the publication and communication of information on such subjects.

(c) To acquire and dispose of property for the purpose aforesaid.

(d) To do all other things incidental or conducive to the attainment of the above objects or any of them.

13. **Institute of Chemistry.** No information.

14. **Institution of Engineers and Shipbuilders in Scotland.**

(1) The Incorporation of the present Institution of Engineers and Shipbuilders in Scotland under the Act 30-31 Vict. chap. 131. and

(2) To facilitate the exchange of information and ideas amongst its Members, to place on record the results of experience elicited in discussion, and to promote the advancement of science and practice in Engineering and Shipbuilding.

(3) The doing of all such other lawful things as are incidental or conducive to the attainment of the above objects.

CORRESPONDENCE

A Professional Card of 1846

Editor, *Journal:*—

Dear Sir:—

The following is a copy of an advertisement which I discovered in a Toronto newspaper (Examiner) of December 30th 1846. At that date railway construction had not commenced in Canada. It was the era of macadamized and toll roads. Companies were promoted and organized for the construction of roads, and many engineers and surveyors were employed. Railways were then in operation in Great Britain and companies were being promoted in Canada.

J. Ellis — Civil Engineer

"Horizontal, Inclined, and Undulating Lines of Railways surveyed, Macadamized and Plank Roads, Canals, Docks, Harbours; every description of Drainage, Tunnels and Bridges of Brick and Stone, Iron and Wood, both Pendant and Insistent, with Correct Specifications.

"Sections or Model Maps, and estimates showing the true cost of construction, founded upon Rules and principles strictly Mathematical, obtained through sixteen years experience and active practice, both as Engineer and Contractor.

"N.B.— J. E. will give detailed estimates if required to persons employing him, showing and proving that his calculations are founded upon true Principles, with Plans, Sections, or Model Maps, showing the true cubic measurements of Cuttings, Embankments, Grading and Side Drains, so simplified that almost any person may keep a correct check as the work proceeds upon the quantity of work done."

Peter street, Toronto.
Dec. 29-1846

If you consider the professional card of Mr. J. Ellis of sufficient interest, you might publish it in *The Journal.*

Sincerely yours,

WILLIS CHIPMAN, M.E.I.C.

Engineering in Southern Provinces, Nigeria

Eastern Railway Constr'n.
Enugu, Southern Provinces, Nigeria.
March 8th, 1922

Editor, *Journal:*—

Dear Sir:—

Reading Mr. G. B. Hull's letter in *The Journal* for December, reminded me of your unanswered letter. Curiously enough we are faced with closing down here for very similar reasons and some Europeans who proceeded on leave last month have had their contracts cancelled, ours will be also, we expect, as our leave comes due.

The work here, and especially the working conditions. has been very interesting, it was intended to continue the existing line (Port Harcourt—Enugu) northwards across the Benue river, linking up with the Lagos-Kano line at Kaduna. Enugu is the station for the Udi coalfields; supposed to be one of the largest known. It is soft coal and that near the surface is not of first quality though I understand the quality is expected to improve. The transport of this coal cheaply to Northern Nigeria and especially the mining areas of the Bauchi plateau is one of its objects and it is anticipated that these mines would be able to operate smelters on the property and reduce their present cost of production. It seems quite evident that construction work, for the present, will not proceed beyond the Benue and possibly stop before the Benue is reached.

Earthworks, bridges and culverts, and tracklaying are done under separate staffs. There are two points which seem of special interest to me, one in construction methods and one in administrative policy:—(a) Instead of abutments and wing walls the bridges on this work have "land spans", usually of 20 feet. I understand it is considered cheaper and the concrete work less complicated, (the latter is a great consideration where all labour, skilled and otherwise, is native and the best is very inferior workmanship). The slopes of the banks are "pitched" to above high water level. (b) Construction is carried out quite independently of the existing railway department, or "open lines", and I understand the chief construction engineer is appointed by and responsible to the governor of the Colony.

The working capacity of the native between Enugu and Northern Nigeria is small; I would judge the total average per man for the 40 miles from Enugu does not reach one yard per man per day, certainly not more than one. I have known of one or two causes where a gang, (25), has moved 75 yards in one day under the most favourable circumstances. It is all head work; shovels are used solely for filling headpans and one can see natives filling headpans to transfer earth a distance of 15 feet.

There is a scarcity of sand and stone and, at times, water. The water courses have not been extensively examined and, unless actually seen in flood, it is almost impossible to estimate its volume with accuracy. The rise and fall is so sudden that little, if any,.trace of H.W. mark is left afterwards and one might well see the same water course a number of times during the rainy season and yet not see it within 10 feet of its maximum flood level. I have seen a practically dry channel in the morning and the same afternoon seen a river 60 feet wide and from 5 to 10 feet deep in the centre.

It is not considered economical to carry more than four chains — all extra excavation from cuttings is wasted on the side and the banks made up from borrow pits. Banks are constructed from the bottom upwards in lifts of three feet.

I trust this will be of interest to you. It is only intended to convey a rough idea of the work.

Sincerely yours,

BERNARD H. HUGHES, JR. E.I.C.

Assistant Engineer

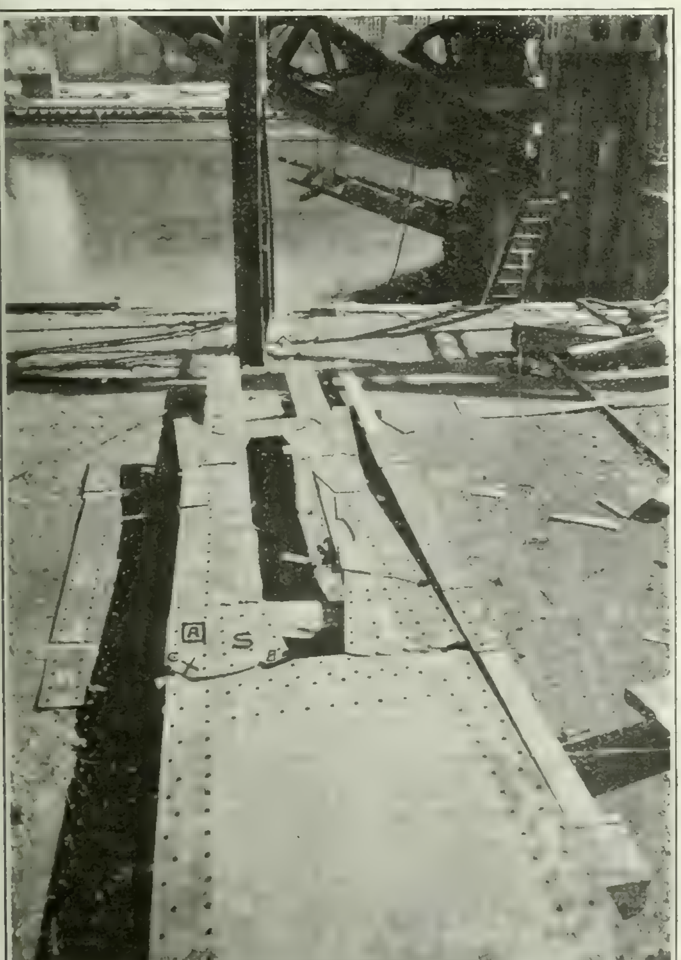
Investigation of Failure of Top Chord Covering Plate of Boom of Dredge "Industry"

Editor, *Journal*:— Ottawa, April 5th, 1922

Dear Sir:—

An interesting investigation has been carried out by the Laboratory for Testing Materials, Department of Public Works, Ottawa, with regard to the failure of the top chord covering plate at bottom end of the boom of the dredge "Industry", (No. 109), operating in the Georgian Bay district. This dredge was built and commissioned in 1906 and was in service until 1920 when the boom was dismantled and reconstructed because of the failure of this covering plate and other reinforcing members at the bottom end of the boom.

This three-eighth inch plate was used as a top reinforcement at the bottom end of the boom, it was fifteen feet eight inches in length and five feet three inches in width. It was riveted to the main longitudinal members of the boom and was reinforced around the aperture by reinforcing strips, these strips on the outer edges supported the pillow blocks for a seven and one half-foot idler which worked in the aperture. This idler supported the bucket cable and its peripheral speed would be about seventy-five feet per minute.



The chord covering Plate at bottom end of Boom, showing Fracture.

For investigation purposes the piece of plate marked "S-X" in the accompanying photograph, was sent to Ottawa. The edge along one fracture was considerably worn, while that of the other fracture was quite intact. The chemical analysis made in the laboratory from the borings taken from the plate at "A" (see photograph) was as follows:

Carbon	0.23%
Sulphur	0.09%
Phosphorous	0.053%
Manganese	0.41%
Chromium	0.13%

The tensile strength of the steel was obtained from two pieces cut from the inside of the plate. The results of this test as performed were as follows:

First Test	No. 1	No. 2
Yield point	61,319 lbs. per sq. in.	30,436 lbs per sq. in.
Ultimate strength	61,319 " "	51,906 " "
Strength at breaking point	45,693 " "	44,935 " "
Elongation, per cent	14.06	12.50

After Test	No. 1	No. 2
Reduction in area at point of fracture	51.44%	55.64%
Reduction in area at centre of sample	10.95%	5.10%
Reduction in area at end furthest from break	0.88%	25.10%

The results of the first test were unusual in that the yield point and ultimate strength were the same. No explanation can be given for this peculiarity.

As this laboratory is not equipped for making microscopic examination of metals, the Department of Mines consented to do this work and reported as follows:

"Specimens for microscopic examination were cut from the piece of the fractured plate sent to this office, at the points marked A. B. and C. Samples for analysis were taken from the place marked A by the Department of Public Works, and from the place marked C by the Mines Branch laboratories.

Chemical Analysis:—

Carbon	0.23%
Manganese	0.42%
Phosphorous	0.053%
Sulphur	0.067%

Microscopic examination:—

Three samples were taken for examination; sample A from inside of plate about three inches from the edge and samples B and C from the edge of the plate close to fracture.

Sample A shows the normal structure of a low carbon steel. The various constituents, pearlite and ferrite are well defined and evenly distributed.

Sample B has the same fracture as A but is faulty in that it contains small inclusions of non-ferrous material. There is also evidence of slip lines or fatigue, probably due to the vibration of the plate in use.

The structure of sample C is similar to B.

Fracture

Sample A shows a fine fibrous fracture. Sample B is coarse and crystalline, evidently due to fatigue as shown by microscopic examination. Samples A and B are quite different, in that A is tough while B is brittle.

There does not appear to be any microscopic reasons for seriously condemning this plate. The chemical analysis does show faulty material as the sulphur and phosphorous are too high for a first-class structural steel plate.

No microphotographs were taken as there was nothing striking or unusual observed in the polished sections examined".

In conclusion, it may be said that the purpose of this department, in investigating this failure, was to find out whether it was due to faulty design or from the fatigue of the material. From the foregoing report it is shown that the failure may be attributed to fatigue and chemical composition of steel. It may not be amiss to point out that fatigue of the metal must have been brought about at the points where the fractures developed by faulty design. It is very obvious that the design employed caused vibrations to be concentrated at certain nodal points which afterwards became lines of fracture.

Yours very truly,

E. VIENS, A.M.E.I.C.

Superintendent, Testing Laboratory,
Department of Public Works.

The Pavement of Sherbrooke Street, Montreal

Editor, *Journal:*—

Dear Sir:—

May I ask space in our *Journal* to call to the attention of our Municipal and Provincial Highway Engineering members throughout Canada, who may have an opportunity to visit Montreal in the near future, the present condition of the coarse mixture asphaltic concrete pavement wearing surface on Sherbrooke street, Montreal, east of McGill College avenue to Champlain street, and west to Atwater avenue. This pavement is also laid on some of the side streets between Sherbrooke street and Burnside Place, Metcalfe and Victoria streets for instance.

The purpose of this letter is to request my fellow members who are interested in street and road paving to inspect this pavement now, before it is extensively repaired or relaid, because later I wish to discuss with them professionally certain matters in connection with it, namely:

1. What is the real value of a five year guarantee on street paving; and should such guarantees be abandoned as comparatively useless and productive of a false impression of security?

It seems to me that Sherbrooke street proves such a guarantee of but little value and that the practice of depending upon such security should be abandoned.

2. Are lawyers who are not engineers, when appointed judges, able to render intelligent decisions upon engineering controversies?

It seems to me that the present condition of Sherbrooke street conclusively proves the contrary. Certainly no engineer specializing in paving matters, acting in a judicial capacity, would have been misled into forcing the city of Montreal to accept and make the final retained payment on Sherbrooke street.

There is something wrong somewhere when a city is compelled to accept and pay for an asphaltic concrete pavement wearing surface, the formula for the mixture of which was under the technical control of the contractor, despite the fact that every driver of an automobile in Montreal knows what its record has been and that it has been a failure as a pavement wearing surface from the first; and I wish my fellow engineers to see for themselves now so that later discussion may be better conducted.

Yours very truly,

CHARLES A. MULLEN, M.E.I.C., M.A.S.C.E.,

Consulting Paving Engineer and
Director of Paving Department—
Milton Hersey Company Limited

* * *

Canada's Forest Experiment Stations

The field work on the Dominion Forestry Branch forest experiment stations is being vigorously pushed this season. There are two permanent stations, one on the Petawawa Military Reserve in the white pine region of Ontario, the other at Lake Edward in the pulp lands of Quebec, on the Laurentide Company's holdings. The main object of the work is to discover the proper means of securing a continuous crop of timber on cut-over lands, and of putting lands at present unproductive on a productive basis. The two experiment stations form the nucleus of the Dominion forest research organization. This organization embraces work on the Dominion forest reserves in the West and similar work in various parts of the East; the latter in co-operation with lumbermen and pulp companies, who, in common with provincial foresters and many others, are lending their enthusiastic assistance to the work.

Trade Publications

Built to endure. Koehring Company of Milwaukee, Wisconsin, have recently issued a very attractive and beautifully illustrated booklet containing "Comparative examples of notable ancient and modern construction, embodying the element of permanency," prepared by Philip Koehring.

The subject matter is arranged so as to compare works of the past ages with the more modern engineering achievements and in connection with each description interesting historical and technical data are given. Some of the ancient works described are "The Acropoles at Athens; The Colosseum at Rome; The Roman Viaduct at Nimes; The Bridge of the Seine; The Appian Way; while those of our own day include, "The Bush Terminals; The Stadium of the New York Yankees; The Tunkhannock Viaduct; Hell's Gate Bridge; The Lincoln Highway, and The Elephant Butte Dam".

In the "Foreword" of the booklet is expressed the thought which must surely occur in the consideration of such a comparison of works, "Modern science and industry have added new discoveries to these age old secrets, producing synthetic stone more enduring and permanent and a more pliant and ready servant of the architect and builder. The men who have made possible these achievements in concrete are entitled to the honour credit and glory of enlarging, preserving and perpetuating, the wonderful civilization which we are now enjoying".

Preliminary Notice

of Applications for Admission and for Transfer

19th May, 1922

The By-laws now provide that the Council of the Institute shal approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in June, 1922.

FRASER S. KEITH, Secretary.

*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option, Railway, Municipal Hydraulic, Mechanical, Mining or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects, Geography, History (that of Canada in particular), Arithmetic, Geometry, Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits scientific acquirements or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BABCOCK—HAROLD AUSTIN, of 40 Orchard View Blvd., Toronto, Ont. Born at Oshawa, Ont., July 8th, 1894; Educ., B.A.Sc. Univ of Toronto, 1917; 1914, surveying, Gibson & Gibson; 1916, inspr. of paving, Dept. of Works, Toronto; 1917, Dominion Bridge Co.; 1918-20, design of hydraulic structures, H.E.P.C. of Ont., Toronto; 1920 to date, with James, Proctor & Redfern, Toronto, Ont.

References: E. M. Proctor, E. A. James, T. H. Hogg, M. V. Sauer, P. Gillespie, A. E. Nourse, C. R. Young.

BEESTON—GORDON KING, of Nelson, B.C. Born at Winnipeg, Man., Aug 12th, 1888 Educ., High School and pvte tuition; 1908 (summer) boundary survey Yukon and B.C.; 1911-12, location and constrn., C.N.P.Rly; 1914 to date, Dept of Interior, Dom Water Power Br., at present, hydrometric recorder (classification) B.C. Hydrometic Survey, Dominion Water Power Branch.

References: J. B. Challies, J. P. Forde, W. Ramsay, R. G. Swan, C. E. Webb.

BRADLEY—NICHOLAS HILBURN, of Box 514, Lethbridge, Alta. Born at High River, Alta., March 27th, 1892 Educ., 3 yrs civil engr'g. McGill Univ., D.L.S. 1918 and A.L.S. 1919; 1912 (summer) rodman C.N.R.; 1913 topog'r Nthrn Rly. Co., Calumet North, Que.; 1913-14 location dftsman., I.C. Rly; 1915-16 (seasons) 2nd asst. on D.L.S. in Northern Alta., under W. H. Waddell and A. E. Glover, Edmonton; 1917 to date (during summer seasons) asst. to dist. surveyor and engr., Surveys Branch, Dept. Pub. Wks. Alta

References: T. F. Francis, J. D. Robertson, S. G. Porter, G. N. Houston, J. Congdon.

FENNER—THOMAS HENRY, of 311 Kendal Avenue, Toronto, Ont. Born at Liverpool, England, April 4th, 1881; Educ., 5 years engr'g. course, Liverpool School of Science, Technology and Art, 1896-1901. Apprenticeship in fitting, erecting, and drawing office, Messrs. Fawcett Preston & Co., 1896-1901. 1901 (Apr.-Nov.), Palmers Shipbldg. and Iron Co.; 1901-07, engr. in sea-going vessels, from 4th to chief engr. Obtained extra first class Board of Trade cert. 1905; 1908-09, supt. of steampower, Riordon Paper Co., Hawkesbury; 1909-11, chief engr., Thomas Davidson Mfg. Co., Montreal; 1912-16, inspecting engr. for Canadian Casualty Boiler Ins. Co., Toronto; 1916-18, plant engr., and asst. works mgr., Singer Mfg. Co., St. John's, Que.; Sessions 1920-21 and 1921-22, instructor in power plant engr'g., 2nd year, Toronto Central Technical School; At present, Editor, "Power House" and "Marine Engineering of Canada".

References: M. B. Watson, F. A. Combe, I. J. Tait, J. T. Farmer, H. Wright.

FLANNIGAN—EDWARD PATRICK, of Montreal, Que. Born at Avondale, Conception Bay, Nfld., September 26th, 1887. Educ., grad. short period courses 1921-22 Michigan University; 1913-15 install. of machinery, laying out roads, erecting bldgs. and gen. survey work, Lally Gold Mining Co.; 1916-18 cost work stores dept., Mt. Ryl. Tunnel and Terminal Co.; 1919-22 paving inspctr. and supervising engr. Milton Hersey Company Ltd., Montreal, and to date.

References: W. C. Adams, C. A. Mullen, A. H. Blanchard, J. W. H. Ford, J. E. Blanchard.

FOGARTY—ORVILLE ALDEN, of 325 Mackay St., Apt. 3, Montreal, Que. Born at Montreal, April 26th 1881; Educ., Mont St. Louis College, Montreal; 1898-1905 genl. engr.g., J. H. Hunter; 1906 design and constr. of Chapleau Elec. Co., Steam Power Pant; 1907 Weyburn Elec. Co., Weyburn, Sask; 1908 engr. in charge of constr., Algoma Power Co.; City of Saskatoon 1909 in charge of elec. install.; asst. supt., Robertson Asbestos Mining Co., Robertson, Que., 1911-12; supt. in charge of mtce., Canadian Steel Foundries Ltd., 1918 to date consulting engineer., at present engr. Pennsylvania Mold and Iron Corp., Pittsburgh, Pa.

References: J. H. Hunter, W. L. Scott, W. Chipman, R. E. Hunter, H. M. Jaquays, W. S. Atwood.

HUNTER—WILLIAM HOWARD, of Montreal, Que. Born at Toronto, Ont., May 31st, 1896; Educ., B.A.Sc., Univ. of Toronto, '20; 3 yrs. overseas Lieut. and Capt., Can. Engrs., 1920 (May-Sept.) asst. res. engr., building substruction for new C.P.R. cantilever bridge, Foundation Co. Ltd., St. John, N.B.; 1920-21 (Sept.-May) building a bulkhead in Bronson Channel, Ottawa, Foundation Co., Ltd. 1921 (June-Sept.) in chg. of field survey party for C. H. and P. H. Mitchell, Toronto; 1922 to date, res. engr., building new bridges piers for C.P.R., at Buckingham Junct., Que. for Foundation Company, Ltd., Montreal.

References: C. W. Allen, W. G. McGhie, H. W. Tate, L. C. Jacobs, F. G. Rutley.

GLADMAN—VICTOR LIONEL of 192, Glenrose Ave., Toronto, Ont. Born at Lindsay, Ont., April 23rd, 1887; Educ., B.Sc., McGill Univ., '10; under grad. Univ. of Toronto in Arts; 1909 (June-Aug.) dftsman, engr'g. dept., Ross & McFarlane, Arch'ts., Montreal; 1911-12, asst. to principal engr., Carrere & Hastings, Arch'ts., New York City; 1912, designer and dftsman, A. H. Harkness, Conslt'g. engr., Toronto; 1913-14, private practice, arch't., and engr., Toronto; 1916, supt. engr. of constrn., Trusts and Guarantee Co. Ltd., Toronto, new building; one year and one month Structural Stee Detailer — McGregor & McIntyre Ltd., Toronto; 1917-Nov. '18, naval arch't and engr., British American Shipbuilding Co., and Dominion Ship Building Co.; 1918 and 1919, designer and dftsman., A. H. Harkness, Toronto; at present ch. engr., Sproatt & Rolph, Archt's., 36, North Str., Toronto.

References: A. H. Harkness, T. T. Black, R. H. Mulock, G. K. McDougall, E. R. Pease, J. G. G. Kerry, E. T. Bridges.

HUTTON—LIONEL ALFRED BENNETT, of Calgary, Atla. Born At Winnipeg, Man., 1883; Educ., I.C.S.; 1904 (July-Nov.), outside foreman, Lethbridge Electric Light and Power Co.; 1904-07, supt. MacLeod Electric Light and Power Cô., 1907-09, electric supplies; 1909-11, inspr. of telephones, C.P.R.; 1911 to date (with exception of 1916-19, when overseas), inspector of telegraphs, C.P.R. with charge of constrn. mtce., equipment of telegraph and telephones lines and offices, approx. 1,000 miles of line.

References: R. S. Trowsdale, F. W. Alexander, R. MacKay, R. C. Harris, J. B. Riddall, R. S. Stronach, D. T. Townsend.

PAINE—ARTHUR JAMES CARMAN, of 98 Blackburn Ave., Ottawa, Ont. Born at Trinity, Nfld., Aug. 21st. 1886; Educ., B.Sc. (Arch.) McGill Univ., 1910; 1909-10, genr. layout and engr'g. work, Byers & Anglin Ltd.; 1911-13, supt., Robert Findlay Co., Arch'ts.; Montreal; 1913, chg. of constrn., Sun Life building, Dominion Sqr., Montreal, under Darling & Pearson, Arch'ts, Toronto; 1918 to date, design work, heating, ventilating, etc., with Mr. Pearson and Darling & Pearson; recently appointed arch't., for Normal School (reinforced concrete building) St. Johns, designed structure 1922 (June)to take chg. of erection of addition to Sun Life Assce.,Head office building, under Darling & Pearson.

References: R. J. Durley, E. A. Ryan, E. S. Mattice, A. F. Byers, F. Peden.

SLIPPER—STANLEY EADES, of 403 Lancaster Boulevard, Calgary, Alta. Born at Port Arthur, Ont., May 2nd, 1890; Educ., B.Sc., Queen's Univ. 1911; During college vacations, with D.L.S., chemist's helper and asst. chemist, student asst. geol. survey work; 1911, field asst., Geol. Survey, Alta.; 1911-12, Jasper Park Collieries; 1912, asst. geol., Alaska-Yukon boundary survey; 1913, asst. geol., Geol. Survey, Queen Charlotte Is., B.C.; 1913-14, investigating boring operations, Alberta; 1914, in charge geol. investigations, Sheep River Oil Field; 1914-16, in charge Calgary office, Geol. Survey; 1916-18, in charge Edmonton office, Geol. Survey; 1918, fielding mgr., boring operations, Can. Northern Oil Co.; 1918 to date, petroleum engr., Mining Lands and Yukon Branch, Dept. Interior., in charge of all oil and gas investigations in western Canada.

References: L. B. Elliot, O. S. Finnie, B. L. Thorne, G. W. Craig, L. C. Charlesworth.

STEERS—FRANCIS PAUL, of 543 Besserer St., Ottawa. Born at Ottawa, Jan. 15th, 1891; Educ., 2nd yr. applied science, Univ. of Toronto, 1912, D.L.S., 1913; 1908 (May-Oct.) rodman, recorder and transitman on surveys; 1909-12, measuring angles of tertiary triangulation along Int. Boundary 49th parallel of lat.; 1913-15, ch. asst. on Lake of the Woods and Lake Superior surveying; 1916-19 overseas, Lieut. and Capt., 2nd. F.C.C.E., and 2nd bn. C.E.; 1919 (May-Oct.) reconnaissance along 104th mer.; 1920 to date, Geodetic engr., Geodetic Survey of Canada, and at present engr. in charge detailed topographical survey of City of London.

References: J. J. McArthur, N. J. Ogilvie, D. H. Nelles, G. H. McCallum, G. F. Dalton.

THOMAS—CECIL OLDRIEVE, of 705 Colebrook Ave., N.D.G., Montreal, Que. Born at Launceston, England, July 13th 1878; Educ., Imperial College of Technology 1900, Univ. of London; 1904-07 dftsman. General Electric Co., U.S.A.; 1907-11 British Thomson Houston Co.; 1911-12 Canadian Westinghouse Co.; 1912-16 asst. engr. and dftsman., Fraser & Chalmers of Canada; 1917 Algoma Steel Corpn.; 1917-18 Canadian Car & Foundry Co.; 1919 and 20 engr. asst. and dftsman., Dominion Bridge Co.; 1921-22 Canadian Car and Foundry Co.; at present fuel engr., Montreal Light Heat and Power Co. Montreal.

References: H. H. Vaughan, J. T. Farmer, G. E. Bell, F. Newell, G. E. Newill, R. H. Findlay.

WESTLAND—CLARENCE ROBERT, of Ottawa, Ont. Born at Wyoming, Ont., Dec. 8th, 1883; Educ., B.Sc., McGill Univ. 1907. D.L.S.; 1906, asst. res. engr. and asst. constrn. engr., G.T.Rly.; 1907-12 in charge International Boundary Survey party; 1913 engr. in charge of topog'r. parties thirty-one Mile Lake Water Supply project; 1914-15 plans and computing geodetic work; 1916-20 charge Internat. Boundary work; 1921, office engr., Irrigation Branch; at present geodetic engr., on precise level adjustments, Geodetic Survey Branch, Dept. of Interior, Ottawa.

References: N. J. Ogilvie, J. J. McArthur, J. D. Craig, W. M. Tobey, F. C. C. Lynch, H. M. Barton, F. B. Reid, D. W. McLachlan.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

MARROTTE—LOUIS HENRY, of 2118 Hutchison Street, Montreal, Que. Born at Montreal, Dec. 23rd, 1882; Educ., B.Sc., McGill Univ. 1904; 1901-02 (summers) shops, Royal Electric Co.; 1903 (summer), rail bonding, Montreal Street Rly.; 1904-10, with the Montreal Light Heat and Power Co., as follows:—1904-06, gen. testing and in charge of meter and instrument tests, 1906-08, asst. to supt. of constrn. (overhead and underground), 1908-10, asst. supt. of substations in charge of mtce. and operation,1910-11, Central Georgia Power Co in charge of bldg , 6600 volt distribution in Macon, Forsyth & Griffin, Georgia, and in charge of operation of 66000 to 6600 volt substations in same towns. Also designed and installed 2000 K.W. substation 66000 to 6600 volts at Barnesville, Georgia; 1911-13, in charge of building 13200 volt transmission line, South Porcupine, Ont.; 1913-date, with Montreal Public Service Corporation and the Canadian Light and Power Co. as follows:—1913-15, in charge of layout of overhead distribution and underground cable system; 1916 to date, asst. to chief engineer.

References: K. B. Thornton, A. Surveyer, F. B. Brown, C. J. Desbaillets, deG. Beaubien.

NIXON—RICHARD LEWIS, of Windsor, N.S., Born at Halifax, N.S., July 1st, 1888. Educ., B.Sc. (C.E.) N.S. Tech. Coll., 1916; 1912-13 and 15 and 17 (summers) dftsman, ch. clerk, engineers' office, Dom. Atl. Ry.; 1914 (summer) masonry insptr., Windsor Rly. Bridge; 1919 (May-Dec.) ch. dftsman in chg. of designing, estimating etc., for Federal and Prov. aid road constrn. Prov. Highway Bd., Halifax; 1916-17-18-19, lecturer in chg. engr'g' dept., King's coll., Windsor, N.S.,—in absence of regular professor overseas; 1920, appointed to chair of engr'g., at King's Coll.; at present prof. of engr'g., King's College, Windsor, N.S.

References: H. C. Burchell, J. W. Roland, G. G. Hare, M. K. McQuarrie, W. P. Morrison, F. A. Bowman, J. L. Allan, B. Ripley, F. R. Faulkner, I. P. MacNab.

PAULIN—FREDERICK WILLIAM, of 153 Fairleigh Ave., S. Hamilton, Ont. Born at Arthur, Ont., Sept. 16th, 1882; Educ., grad. civil engr'g., Univ. of Toronto '07, O.L.S. '08; 1904 (summer) chg. testing dept., Ontario Power Co.; 1905-06, base line work; 1908 asst. to ch. engr., Toronto, Dept. Pub. Wks.; 1909-11, gen. engr'g. practice Niagara Falls, Ont.; 1911-13, mgr., Mackay Paulin Constr., Co.; 1913-date mng'g. dir., Canadian Engineering and Contracting Co. Ltd.; 1914, designed high level interceptor for City of Toronto; 1915-19 designed and constr'd. foundations for Dom. Steel Engrs., Hamilton and Canada Car Fdrs., Welland; 1921, foundations for Bascule Bdge., Burlington Channel (constrn).

References: E. H. Darling, R. K. Palmer, W. Hollingworth, J. M. Wilson, H. U. Hart, J. J. MacKay.

PHILLIPS—JAMES BENJAMIN, of 18 Spadina Crt., St. Mary's Ave., Winnipeg, Man. Born at St. Florence, Pembrokeshire, South Wales; June 24th, 1874. Educ., Ellesmere College, England; 1897-1901, land surveys; 1901-02, instr'man. Public Wks. Dept., Man. 1903-04, rodman, Can. North West Irrig., Co., C.N.Rly.; tpog'rG.T.Rly; 1904 (April-Dec.) res. engr.,C.N.Rly.; 1905 (Jan.-Apr.) asst. engr. exploratory survey, Nat. Trans. Rly. and 1905-06, transitman N.T.Rly.; 1906-07, res. engr., G.T.P. Rly.; 1908-09, res. engr., Trans. Rly.; 1910, supt. constrn., G. H. Webster Co., Tofield Branch, G.T.P. Rly.; 1911-12, supt. constrn. D. F. McArthur Co., C.N.Rly 1913, res. engr., C.P.R.; 1914 (Jan.-Mar.) locating engr., Grain Belt Development Co.; 1914 (May-Sept.) dist. engr., Good Roads, Manitoba; 1916-17, inspctr., Greater Winnipeg Water Dist.; 1918, supt. constrn., Can. Lock Joint Pipe Co., Transcona; 1919-20, res. engr., C.N.Rly.; 1921 to date, mgng. partner, Phillips and Maxwell, contractors, Winnipeg.

References: G. F. Richan, E. M. M. Hill, F. G. Haven, E. R. Millidge, W. R. Harris, A. McGillivray, R. W. Jones, W. Burns.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

BEAUDOIN—HORACE, of Hawkesbury, Ont. Born at Montreal, Que., Oct. 4th 1892; Educ., 1909-11, Ecole Polytechnique, Montreal; 1910 (summer) rodman on transmission line constrn., Shawinigan Water Power Co.; 1911 (summer) and from Nov. to June '12, transitman on surveys, Boucher & Demers, Montreal; 1912-13, instr'man and dftsman. on municipal improvements for City of Maisonneuve; 1913-14, chf. of party on land surveys with F. C. Laberge, Montreal; 1914 (Apr.-Aug.) asst. to city engr. in chg., surveys for City of Maisonneuve; 1914-16 on active service overseas and in Canada; 1916-17, chf. of party on topogr. survey for power development on St. Francis River, Que., under M. D. Barclay, Montreal; 1917-18, asst. engr. to E. Drinkwater, Town Engr., Montreal,; 1918 to date chg. of design and supervision of constrn. of water wks., sewers, highway bridges etc., with V. E. A. Belanger, consltg. engr., Hawkesbury, Ont.

References: V. E. A. Belanger, F. C. Laberge, M. D. Barclay, C. B. Bate, A. G. L. McNaughton, J. E. Bertrand.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

AFFLECK—JOHN KNOX of 2, Spadina Rd., Toronto, Ont. Born at Perth, Ont., June 3rd, 1894; Educ., B.A.Sc., Univ. of Tor., 1921. 1913 surveying, Green Bros. Burden and Co., B.C.; layout work Canadian Explosives, Nobel, Ont.; 1915 (May to Sept.)Internat. Nickel Co., Copper Cliff, Ont.; Dec. 1916-Feb. 1919, works chemist Ministry of Munitions of War Dept. of Explosives Supply, Gretna, Scotland; Mar.-Oct. 1919work on reverberatory furnace and in Laboratory; 1920 (May-Oct.) works chem. Standard Chemical Co., Montreal. At present works chem. Imper. Varnish and Color Co., Toronto, in dry color dept.

References: P. Gillespie, C. R. Young, H. E. T. Haultain, J. R. Cockburn, G. Affleck.

BISHOP—TRENHOLME ALLEN GILL, of 9 Summerhill Ave., Montreal, Que. Born at Montreal, January 1st 1897; Educ., B.Sc. (E.E.) McGill Univ. 1921; 1916 (summer) shell shop etc., Steel Co. of Canada; 1917-19 Lieut. R.F.C. and R.A.F.; 1920 (summer) elec. mtce. dept., Northern Electric Co.; 1921 to date engr. engr'g. dept., Montreal Public Service Corpn., Montreal.

References: K. B. Thornton, W. H. Breithaupt, L. A. Herdt, F. B. Brown, L. H. Marrotte, C. M. McKergow, C. V. Christie.

BOWMAN—NELSON, of 31 Mill St. Montreal. Born at Ayr. Ont. Dec. 29th, 1894; Educ., B.A.Sc. (civil) Univ. of Toronto, 1921; 1918 (June-Nov.) Canadian Aeroplanes, Toronto; 1918-19 (Nov.-July) Dominion Tire Factory, Kitchener, Ont.; 1919 (July-Oct.) and 1920 (April-July) Ames Holden Tire Factory, Kitchener; 1920 (July-Nov.) had complete charge of design and erection of 3 storey warehouse of concrete beam and girder type and 1921 (April to the present) complete charge of design and erection of a concrete grain elevator and workhouse with Dominion Linseed Oil Co., Baden, Ont.

References: P. Gillespie, C. R. Young, W. J. Smither, S. G. Talman, W. D. Walcott.

DICK—VICTOR WILLIAM, of 50 Bristol Str., Hamilton, Ont. Born at Winnipeg, Man., June 12th, 1897; Educ., B.Sc. (E.E.) Univ. of Manitoba, 1921; 1920 (summer) dftsman., Winnipeg City Hydro; 1921-22 (June-April) test course, Canadian Westinghouse Co., Hamilton; at present correspondent, detail division, Correspondence dept., Canadian Westinghouse Co., Sales dept.

References: E. P. Fetherstonhaugh, J. N. Finlayson, E. V. Caton, W. F. McLaren, J. W. Dorsey, D. L. McLean.

McLENNAN—LOGAN SEAFORTH, of 2560, 1st Ave., W., Vancouver, B.C. Born at Vancouver, Jan. 7th, 1900; Educ., B.Sc., McGill Univ., 1922; two summers employed with pulp and paper at Powell River, B.C.

References: F. A. McKay, E. Brown, R. French, E. G. Matheson, A. Lighthall.

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OF CANADA

JULY 1922

CONTENTS

Volume V, No. 7

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BRANCHES:

Halifax Branch, Halifax, N.S.
Cape Breton Branch, Sydney, Cape Breton.
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Kingston Branch, Kingston, Ont.
Peterborough Branch, Peterborough, Ont.
Toronto Branch, Toronto, Ont.
Hamilton Branch, Hamilton, Ont.
Niagara Peninsula Branch, Niagara Falls, Ont.
London Branch, London, Ont.
Border Cities Branch, Windsor, Ont.
Sault Ste. Marie Branch, Sault Ste. Marie, Ont.
Winnipeg Branch, Winnipeg, Man.
Saskatchewan Branch, Regina, Sask.
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*For 1922 †For 1922-23 ‡For 1922-23-24

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Some Legal Aspects of Engineering Contracts

A Memorandum of the Law relating to Contracts for Engineering Works.

Alfred Bicknell.

Paper read before the Toronto Branch, The Engineering Institute of Canada, April 6th, 1922.

Lawyers

Lawyers, the most trusted and distrusted; the men who make contracts and unmake them; who give advice and sell counsel; who make money out of trouble and make trouble out of money; who create estates and distribute them, legally; who live by loaning money, and often subsist on borrowed capital; who hear and conceal marriage secrets, and drag out faded letters in bitter divorces; who please and persuade when they are lucky, but often go out of court branded and dispraised by the side defeated, and with one side always the loser, — what wonder that the slurs of character fall to the common lot of the lawyer!

Without the smiles of the merchant's customer, he meets the frowns of business men in trouble. No time is to be lost, no delay for fees. He must win a victory or bear the blame forever. Unlike the builder, who knows that be it ever so perfect, the elaborate house he has finished can never suit the proprietor; unlike the machinist, he controls not his own enginery; carrying the double burden of care for self and client, invited to win what others have failed in; urged to mend the broken pieces of an ill-made contract; bound to account for unreasonable confessions, blunders, and letters; asked to replevin goods already secreted, to attach the effects of a malicious merchant, to unearth fraudulent elections, to reclaim vast estates from costly tax titles, to keep one for years in plenty by restored possession and broken wills, often on doubtful evidence by a lawyer's art and eloquence, — what a happy condition!

Fated from the start by uncertainty, where clients exact no less than absolute victory, they long to call reasonable what they know is only probable. By logic and argument on the theory of their client, with the facts only partially stated, and that part deeply shaded, they are often surprised by the other side and called to explain away their defeat in the end by a tirade on the

perjury of witnesses and the depravity of human nature. The happy lawyers! The men who live so easily, flourish so long on the bounty of a grateful people, make the laws and settle the titles, defend the weak and protect the wealthy, enjoy the rich fruit of the world's praises and abuses, mingled and commingled in such rare harmony that none can define where censure ends and approval commences, — who would not be a lawyer!

Law

What is known as "Law", is a set or rather sets of rules and regulations intended to govern the proper conduct and carrying on of the affairs of life. These rules and regulations are the product of ages and some are founded upon the Law of Moses; certain principles are laid down in what is known as the "Common Law" and others are set forth in Legislative Enactments, called "Statutes". The latter may merely declare what is or has been the Law or may make entirely new regulations for the conduct or carrying on of certain transactions.

Legislative bodies in these times seem to feel that the people may consider they are not diligent unless the Legislature enacts each session a large number of new Statutes, whereas it should be a cardinal principle of every Legislature to make as few changes as possible in the existing state of affairs and every amendment made should be of such importance that it would not involve too much expense to reprint the Act as amended, instead of inserting a few amending words here and there throughout the Act. If such were done business men would not have such a laborious task to ascertain what is the existing Statute Law on a particular subject. Legislatures throughout the country and, in fact throughout the whole world, should endeavour to have uniform codes of laws. As matters exist at the present time what is Statute Law in one Province of a Dominion, may be entirely different in another Province, notwithstanding it is only a few yards across the border line. A commencement has been made along this line, but it reminds us of a story of Artemus Ward, where he refers to a railway having been built across the continent, "— it is seven miles in length but it breaks the monotony of the journey".

There are very few codifications of the laws; such as the Bills of Exchange Act, the Criminal Code, Sales of Goods Act, and the Partnership Act. It would be a very difficult matter to codify the law relating to building and engineering works and it seems to be difficult to work out a satisfactory form of contract for these purposes, although the matter is now and has been under way for some few years, but this will be referred to a little later.

Contracts for Building and Engineering Works

The peculiarity of contracts for building and engineering works arises:

(a) From the building owner not knowing accurately what he wants and the consequence and necessity of employing a person of skill to prescribe for him by means of plans and specifications that which he cannot prescribe for himself;

(b) From the building owner not knowing, when the work is prescribed, whether it is what he really wants because of his inability to understand plans and drawings and the technical meaning of specifications. This ignorance of technicalities is a fertile cause of variations and extras after the contract is signed;

(c) From the building owner not knowing, when the work is done, whether the work prescribed in the plans and specifications has been performed satisfactorily or the proper workmanship and materials employed;

(d) From the builder or contractor, for the purposes of his tender, being in the habit of relying entirely upon the plans and specifications of the architect or engineer of the employer, without examining them particularly for himself;

(e) From the plans and specifications frequently omitting sufficient detailed description or from the plans being sometimes impracticable;

(f) From their immense detail and the many and varied risks and contingencies to which the performance of building contracts is subject;

(g) From the great expense attendant upon obtaining estimates for the work;

(h) From the fact that the architect or engineer employed by the building owner is often, by the terms of building and engineering contracts, placed in the peculiar position of valuer between the parties and impartial decider of all questions arising out of the complications of building operations, while at the same time for some purposes he is agent of the building owner.

Perhaps the most peculiar feature of building and engineering contracts is that no acceptance or approval of work can be implied from the employer being in possession of the property on which the work is done. If the builder does not do that which he contracts to do he cannot recover, although the work done be as good as, or better than, that specified; nor can the builder, although he has not been paid, take away that which he has built on the property of the owner, for as soon as the materials are attached to the soil they become part of the realty and even if pulled down they still remain the property of the employer.

In addition to these peculiarities, engineering and building contracts are often composed of conditions of various kinds which seem to have been handed down for years, put together by the engineer or architect in various combinations and producing various legal results of more beneficial interest to the lawyer than to the parties concerned. Even where the precaution is taken of having the contract settled by a lawyer, he is frequently only asked to settle the contract and not the conditions of the contract, which are the all important parts, and even when both the contract and conditions are settled by a lawyer they are only too often then attached to specifications prepared by the architect, containing other conditions which are not consistent with the contract and conditions so settled.

It will therefore be seen that it is very important for architects, engineers and building contractors to endeavour to settle on some satisfactory form or forms of building contracts; one being a straight lump-sum contract and another a cost-plus-percentage contract.

Essential Features of a Contract

A few points in connection with the making of contracts generally will be taken up first. The writer has found, from experience, that the want of a correct knowledge on this matter is the cause of a very great deal of the litigation that finds its way into the courts of the country and from time to time it has been found necessary to endeavour to expound the more important features of a contract.

The object of law is "order", and the result of order is that men are enabled to look ahead with some sort of security as to the future. Although human action cannot be reduced to the uniformities of nature, men have yet endeavoured to reproduce by law something approaching to this uniformity. As the law relating to property had its origin in the attempt to ensure that what a man has lawfully acquired he shall retain, so the law of contract is intended to insure that what a man has been led to expect shall come to pass; that what has been promised to him shall be performed.

Agreement is the expression by two or more persons of a common intention to affect their legal relations. An essential feature of a contract is a *promise* by one party to another, or by two parties to one another, to do or forbear from doing certain specified acts. By a promise is meant an accepted offer as opposed to an offer of a promise. An offer must be distinguished from a statement of intention; for an offer imports a willingness to be bound to the party to whom it is made.

Thus, if A says to X, "I mean to sell one of my sheep if I can get $25.00 for it", this is a mere statement which does not admit of being turned into an agreement; but if A says to X, "I will sell you whichever of my sheep you like to take for $25.00," we have an offer. An offer becomes a promise by acceptance; until acceptance it may be withdrawn; after acceptance its character is changed. If A says to X, "I will sell you my sheep for $25.00," and X says, "I will buy it for that sum," there is a promise by A to sell, and a promise by X to buy, and a contract between the two. To make that sort of agreement which results in contract, there must be, (1) an offer, (2) an acceptance of that offer, resulting in a promise, and (3) the Law must attach a binding force to the promise so as to invest it with the character of a legal obligation.

Every expression of a common intention arrived at by two or more parties is ultimately reducible to question and answer. If X says to A, "Will you give me $5,000. for my house?" and A replies, "I will," a contract is made; but if A says, "I will if you will put a new verandah on the front," there is no acceptance until X agrees to A's terms. The acceptance must be of the terms offered or the matter remains open and no contract is made.

A offered to sell a farm to X for $5,000. X said he would give $4,500. A refused and X then said he would give $5,000., but A declined to adhere to his original offer and no contract resulted, the Court saying the counter offer of $4,500. was a refusal of the first offer.

X telegraphed to A, "Will you sell us Bumper Hall Pen? Telegraph lowest cash price, answer paid". A replied by wire, "Lowest price for Bumper Hall Pen, £900". X telegraphed, "We agree to buy Bumper Hall Pen. for £900 asked by you". The Court said no contract was made, that A in stating the lowest price which he would take was not accepting an offer but supplying information, that the third of the telegrams set out above was an offer by X — not the less so because he called it an acceptance — and that this offer had never been accepted by A.

A offered $1,450. for a property belonging to X. In accepting the offer X enclosed with the letter of acceptance a contract for signature by A. This document contained various terms as to payment of deposit, date of completion and requirements of title, which had never been suggested in the offer. There was no contract; the Court said it would be equally unfair to hold A to the terms of acceptance and X to those of the offer.

Where an offer to sell property was accepted, "Subject to the terms of a contract being arranged," between the solicitors of the parties, no contract was made. The acceptance was not, in fact, more than an expression of willingness to treat. An offer need not be made to an ascertained person, but no contract can arise until it has been accepted by an ascertained person. The proposition is best understood by an illustration: The offer, by way of advertisement, of a reward for the rendering of certain services, addressed to the public at large, becomes a contract to pay the reward so soon as one individual accepts the offer by rendering the services, but not before.

B wrote D, "Please give us your lowest quotation for 3,000 yards of canvas to the enclosed sample". D replied, "We enclose sample nearest we have to yours, lowest price 1—5/8 d. per yard. B then wrote D, "Get made for us 3,000 yards as per your quotation". Held: D's letter was not an offer to sell but merely a quotation of terms on which B might offer an order and there was no contract made by the correspondence; *Bayers vs Duke — (1905) 2 Ir. R. 617.*

A mere advertisement announcing that it is intended to hold an auction sale, constitutes no contract between the advertiser and the highest bidder that the goods shall be sold to him, nor between the advertiser and any intending purchaser that the goods shall be put up for sale at all; *Harris vs Nickerson — L.R. 8 Q.B. 286.*

In a late case in the Supreme Court of Canada decided on June 27th 1921, between the Halifax Graving Dock Company and His Majesty, the King, the same question came up and, in fact, the question is arising so frequently that I consider it is one of the most important things for a business man, especially architects, engineers and contractors, to understand, as they are dealing with all sorts and conditions of men in practically every walk in life.

The facts of the Halifax Graving Dock case are as follows. — The Halifax graving dock and plant were wrecked by the explosion in Halifax in 1917 and in January 1918, the Government of Canada passed an Order-in-Council providing that the contract for repairing and re-constructing it should be entrusted to the Halifax Graving Dock Company, on condition, among others, that the latter should contribute $111,000, the amount of the insurance it carried, and the Government pay the

balance. A letter was sent to the company enclosing a copy of the Order-in-Council and stating that, "an agreement is being prepared and will be submitted to you shortly for your signature," but no agreement was ever executed. Two days later the company wrote the following letter:

> "We beg to acknowledge receipts of yours of the 17th instant enclosing a copy of Order-in-Council with reference to the construction of the Halifax dry dock, which is satisfactory, but in order that all will be quite clear our understanding is that we are to assign our insurance policies to the Government and that the temporary buildings now being constructed are to be replaced by permanent buildings of the same kind as the original."

The company did some work on the dock, but the Minister was not satisfied with its progress and the Government took it over, practically completed it and finally expropriated the property. In proceedings by the company to recover the amount expended on the work, the Court held that the above letter did not contain *an unqualified acceptance of the terms set out in the Order-in-Council;* that there never was a *concensus ad idem* between the parties; Mr. Justice Iddington stating with reference to the letter: "I am unable to hold that the letter was a clear and unconditional acceptance of the offer made by the Order-in-Council. It was clearly a substitution of the assignment of some policies of insurance for an absolute contribution of $111,000 in cash and that cannot be amended by anything passing afterwards going beyond the limitations set forth in the Order-in-Council. The writer of the letter throughout the later correspondence and the litigation which has ensued seemed determined to have his own way and to be taken as absolute interpreter of the language used, and the law bearing thereon. I cannot agree with him and hence conclude that there never was, as the company claims, any binding contract."

Another incident is that there was to have been drawn up a formal contract which, if drawn, never was executed. All that was necessary for the company to have written was: "We beg to acknowledge receipt of yours of the 17th instant enclosing copy of Order-in-Council with reference to the re-construction of the Halifax dry dock, the terms of which we accept." By reason of endeavouring to vary the terms,—and which neither the Deputy Minister of Public Works nor the Minister had power to do without a new Order-in-Council, — the company failed to make a valid contract.

H. and Company wrote The Pulp Company, "We have on hand 1,200 cords of spruce and balsam pulp, which we are willing to sell to you at $12.00 per cord f.o.b. shipping point, shipments to commence immediately and to continue at least .... shipments per month." The letter of acceptance started off something like this: "We are in receipt of your letter of .... and would be glad to have you ship us the pulpwood which you offer, but it must be understood that the wood will be cut in four-foot lengths and will be free from knots and dosey centres and will be good sound spruce and balsam pulp, not more than ten per cent of balsam." No further correspondence ensued on the question of contract, but the shipper commenced to ship and shipped several car loads and then stopped, claiming that the acceptance came so late that a good deal of the wood was sold to other parties and they had no further wood left. An action was brought in connection with the contract and you will see, if you test the matter out, that it rests on two points:

1. A straight offer;

2. An apparent acceptance of the offer, but the acceptance was so qualified that it did not make a contract and without a further acceptance by the seller, of the terms set forth by the purchaser, no contract was made.

All that the purchaser had to do to make a valid contract was to acknowledge receipt of the seller's letter and use four words, "We accept your offer".

If an alleged acceptance is not in fact a straight unqualified acceptance of the terms of the offer or purports to add any new term to the bargain it is merely a counter offer and no contract arises; *Navon Union vs McLoughlin — 4 Ir. R. 451 (1855); Gray vs Smith (1889) 43 Ch.D. 208.*

M offered to purchase an estate from H on the terms of an advertisement and he wrote purporting to accept the offer, but added new terms about a deposit and a date for completion. The letter was not replied to and the Court held there was no contract between the parties; *Honeyman vs Marryatt (1857) 6 H.L.C. 112.*

A letter purporting to accept an offer but enclosing conditions of sale imparting new terms is merely a counter offer; *Crossly vs Maycock (1874) L.R. 18 Eq. 180.*

In response to an offer there was sent a purported acceptance, "Subject to a formal contract, when any minor details can be settled". It was decided there was no binding contract; *Santa Fe Land Co. vs Forestal Land Co. (1910) 26 Times L.R. 534.*

The mere omission to mention one of the terms of the offer in the acceptance, however, is not enough to cause it to be a mere counter offer of all the terms of the offer except the omitted term.

As to Builder being Bound by Offer

A tender or an offer may be withdrawn at any time before acceptance, provided it is not under seal nor made for valuable consideration, ie. it does not amount to an option; *Holland vs Eyre (1825) 2 S. & S. 194;* but unless withdrawn a tender remains in force until it is accepted or lapses by the effluxion of time, viz. a reasonable time under all the circumstances of each particular case; *Murray vs Rennie (1897) 24 R. Ct. of S. 965.*

G offered to buy a house from R and gave R six weeks for a definite answer. It was held that G could retract the offer at any time before acceptance, although the six weeks had not expired; *Routledge vs Grant (1828) 4 Bingham 653.*

A tender is an offer and acceptance of it by the employer gives rise to a binding contract and acceptance is none the less an acceptance because the parties intend subsequently to record their bargain in some formal way.

Lord Justice Brett, (*in the case of Lewis vs Price (1877) 3 Q.B.D. 677*), says: "At the trial the question was whether at the time that the documents were signed the parties had a contracting mind. The Jury found they had and thereupon according to the written rule of Law the true construction of the letters became a matter for determination by the Court. I think that when the letter of the plaintiff's architect had been written and received a contract was made and completed. The contract mentioned in the letter was merely formal." The leading case on the subject is; *Byrne vs Vantienhoven (1880) 5 Q.B.D. 344.*

T sent an offer by letter to B. The letter was posted on October 1st and received on October 11th. B accepted by telegram the same day and by letter posted October 15th. On October 8th, T wrote withdrawing the offer. This letter was received after October 15th. The Court held that the withdrawal was inoperative, a complete contract binding both parties having been entered into on October 11th, that is, by the letter of October 1st, which was received on the 11th and accepted by telegram on the same day. The withdrawal letter was not received until four days after the contract was made. The revocation to be operative must be communicated.

Acceptance

If a mode of acceptance is prescribed and the offeree departs from this, it is open to the offerer to treat the acceptance as a nullity.

Ehasin offered to buy flour of Henshaw, requesting an answer by the wagon which brought the offer. Henshaw sent a letter of acceptance by mail, thinking it would reach Ehasin more speedily. He was wrong. The United States Supreme Court held that Ehasin was entitled to refuse to purchase.

"It is undeniable principle of the law of contract that an offer of a bargain by one person to another imposes no obligation upon the former, *until it is accepted by the latter according to the terms in which the offer was made.* Any qualification of or departure from these terms invalidates the offer unless the same be agreed to by the person who made it."

Contracts with Corporations

A good deal of difficulty occurs with contracts with corporations, unless they are signed by the proper officers and under the seal of the corporation. Contracts with municipal corporations must be under seal in cases where the contract is executory, (that is, where it is to be performed in the future), except as to contracts of an unimportant character of daily occurrence or of urgent necessity; *Clark vs Cuckfield (1852) 21 L.J. Q.B. 349.* But where a municipal corporation receives statutory powers to trade there is no distinction between it and a trading corporation and contracts entered into in the ordinary course of such trading need not be under seal. In a contract not under seal but partly verbal and partly in writing by an electric lighting authority to supply light to a consumer, it is held to be enforceable against such authority; *Bourne vs Marylebone Borough Council (1908) 72 J.P. 129.*

The well known case of Mackay vs City of Toronto is probably the latest case on this point. This case was decided by the Judicial Committee of the Privy Council on August 6th 1919. The Mayor of Toronto instructed John Mackay and Company to prepare a report as to the commercial and financial aspect............ of a contemplated purchase by the respondent corporation of certain undertakings of public utility carried on in the city. Their employment was not authorized by by-law. Under the Municipal Act of Ontario, (Sec. 10), the powers of a municipal corporation shall be exercised by its council (Sec. 249 and 258) by by-law. John Mackay and Company prepared an interim report which was printed by order of the council; Lord Haldane gave the judgment—held — they could not recover.

This is the general law, but if there is power in the Statute to any body to make purchases without by-law, the contracts are good.

In passing it might be mentioned that the city of Montreal has a peculiar Statute governing it with reference to contracts. It was found necessary to have this passed so as to prevent extravagant expenditures, and in dealing with contracts with the city of Montreal it is well to remember this Statute. The provisions are that unless an appropriation has been made for the contract or unless the contract has been passed upon by a certain public Body, the contract cannot be enforced.

An engineer was employed in connection with certain bridge building contracts in Montreal and the percentage was based upon the amount of the contract. Under the original contract the contractor performed considerable work and then was dismissed or abandoned the contract, the reason being that he had taken the contract too cheaply. Tenders were again advertised for and the lowest tender accepted. The second contractor also fell down. Tenders were again advertised for, with a like result, and the work was finally completed by the corporation. The engineer had supervision over the whole of the work, under the various contracts, and the corporation refused to pay him the percentage upon the cost of the work although partial payments had been made. The work was originally to cost $100,000. and finally cost about $300,000. It was found that the Statute relating to the city of Montreal prevented the engineer from recovering by action. One of the contractors got a special Act put through the Quebec Legislature, abrogating the provisions of the Statute and providing that his claim for work done should be arbitrated upon the basis of quantum meruit, but it is not every engineer who could succeed in getting a special Act put through.

Government Contracts and Power of the Crown to Contract

A great deal of difficulty arises with Government contracts and there is often difficulty in enforcing them, because before proceedings can be taken against the Government, by "Petition of Right", it is necessary to have a Fiat from the Attorney-General. There are some Statutory exceptions. A provision has been inserted in the Canadian National Railway Act that proceedings can be taken without a Fiat. This was to be brought into force by Order-in-Council.

The Crown can by its agents, acting within the scope of their authority, enter into contracts and the Attorney-General, suing on behalf of the Crown, can enforce such contracts against the Subject and the Subject can sue the Crown either for money due under the contract or for damages for the breach, but the Subject cannot proceed against the Crown in its own courts in the usual method, by Writ, but must proceed by Petition of Right, first obtaining, as above mentioned, Fiat of the Attorney-General.

According to the principle above laid down that the Crown is only bound by its proper agents acting within the scope of their authority, it is a duty of the Subject who has the contract to enquire whether the person proposing to contract on behalf of the Government is the agent with authority and is acting within the scope of his authority. In the case of *O'Brien vs The Queen (1884) S.C.R. 529*, Chief Justice Mitchel stated as follows: "Neither the engineer nor the clerk of the works nor any subordinate officer in charge of any of the works of the Dominion of Canada has any power or authority, expressed or implied, under the law, to bind the Crown to any contract or expenditure not specially authorized by the express terms of the contract duly entered into between the Crown and the contractor according to law and then only in the specific manner provided for by the express terms of the contract".

In the O'Brien case the contract was under seal with the Minister of Public Works of the Dominion of Canada, to complete the Deep Sea wharf for a lump sum of $78,000, agreeable to plans and specifications and to such directions as should be given by the engineer in charge during the progress of the work. By the seventh clause of the contract no extra work could be performed unless ordered in writing by the engineer in charge before the execution of the work. By letters the Minister of Public Works authorized the contractor to make certain additions to the wharf and the contractor sued for the price of these additions, but the Court held he could not recover.

In the case of *The Queen vs Starr, (1889) 17 Can. S.C.R. 118*, the contractor made a contract with the Crown, represented by the Minister of Public Works for Canada, to construct a bridge for a lump sum. After completion a final certificate was given by the engineer and the amount paid. The contractor subsequently made a claim for the value of the work alleged to have been done but not included in the final certificate, which work they alleged was caused by alterations ordered by the chief engineer of so radical a nature as to create a new contract. The Court held that the engineer had no power to make any such new contract binding upon the Crown.

In a matter relating to the city of Ottawa it was tested in *Goodwin vs Corporation of the City of Ottawa (1878) 561:* The contractor put in a superior class of masonry to that required by the specifications, without the authority of the engineer or the Board of Works, as he stated, because of encouragement received from individual members of the council, "that the city would not let me lose thereby". The Court held that what took place with the individual members of the council could not affect the matter.

Trading Corporations

Trading corporations need not contract under seal in any contract entered into in the ordinary course of the business for which they were incorporated; *South of Ireland Colliery Co. vs Waddell (1869) L.R. 3 C.P. 463.* The contract in this case was for the erection of a pumping engine and machinery for use in a colliery and part of the price was paid.

Reuter vs Electric Telegraph (1856) 6 E. & B. 341. The telegraph company was incorporated by charter and had to make contracts under a certain amount either under seal or by the signature of three directors. Reuter contracted with the company above the prescribed value and not in accordance with the above provisions, but the contract was within the scope of the company's business. Reuter did the work under the contract and was paid by cheque, which passed through the company's account. The Court held that the contract was ratified if not authorized by the company.

After the "Armistice" it was found that there were a very large number of contracts entered into with the Government of the United States and a very great number were at loose ends. Companies were instructed by subordinates, or members of departments, or officers of departments, to go on and do the work, amounting to many millions of dollars and after the armistice these contracts were cancelled and the United States Government refused to acknowledge them and in many instances refused to pay and contractors were more or less at the absolute mercy of the board constituted by the Government of the United States in respect of their claims.

It is therefore very important to consider whether a contractor has a good contract and, at the present time when there would be very keen competition for obtaining building contracts, contractors are liable to overlook this very important point until settling day comes. When once you have the contract landed see to it carefully that the contract is an enforceable one.

Variation of Contracts

Contracts required by Statute to be under seal can only be varied by an instrument under seal, but in other cases the contract under seal or any parole contract may be varied by parole, subject to the rule that a contract necessarily in writing can only be varied by a new agreement in writing.

As most of the building contracts are in writing, this point is only touched on incidentally.

Statute of Frauds

One of the former sections of the Statute of Frauds, section twelve, but now section six of the Sale of Goods Act, is as follows:

"(1) The contract for the sale of any goods of the value of $40.00 or upwards shall not be enforceable by action unless the buyer shall accept part of the goods so sold and actually receive the same or give something in earnest to bind the bargain or in part payment or unless some note or memorandum in writing of the contract be made and signed by the party to be charged or his agent in that behalf.

"(2) The provisions of this section shall apply to every such contract notwithstanding that the goods may be intended to be delivered at some future time or may not at the time of such contract be actually made, procured, or provided, or fit, or ready, for delivery or some act may be requisite for the making, or completing thereof, or rendering the same fit for delivery.

"(3) There is an acceptance of goods within the meaning of this section when the buyer does any act in relation to the goods which recognizes a pre-existing contract of sale, whether there be an acceptance in performance of the contract or not."

A fruit company's representative phoned an Italian fruit firm in Hamilton, "Do you want a car of bananas, eighths, $2.00 per cwt., seaboard?" The Hamilton firm answered, "Yes, we will take a car, but ship them immediately". The representative wired their head office at New York, "Book order for car bananas, eighths, S. & S., Hamilton, at $2.00 per cwt." Head office wired their representative, "Have booked order". By some unfortunate error in the office of their Canadian representative the latter wired S. & S. Hamilton, "Shipping your car to-morrow, — Fruit Company". The order could not be filled, as at seaboard it was found that a large part of the cargo became damaged enroute from Cuba and were unfit for shipment. S. & S. then sued for large damages for breach of the contract, but the Court said it was a contract for the sale of goods, wares or merchandise for $40.00 or upwards and there was no sufficient note or memorandum of the *bargain* signed by the party to be charged or its agent. Nothing was given in earnest to bind the bargain or in part payment, nor had the buyer accepted part of the goods sold and actually received the same. The telegram, "Shipping your car to-morrow", was not a sufficient memorandum of the bargain. The bargain meant the names of the parties, the subject matter and the terms of sale, and the telegram being the only document signed was not sufficient.

Section five of the Statute of Frauds, (old section four), is as follows:

"(5) No action shall be brought whereby to charge any executor or administrator upon any special promise to answer damages out of his own estate, or whereby to charge any person upon any special promise to answer for the debt, default or miscarriage of any other person, or to charge any person upon any agreement made upon consideration of marriage, or upon any contract or sale of lands, tenements or hereditaments, or any interest in or concerning them, or *upon any agreement that is not to be performed within the space of one year from the making thereof*, unless the agreement upon which such action shall be brought, or some memorandum or note thereof shall be in writing and signed by the party to be charged therewith or some person thereunto by him lawfully authorized."

The portion of this section to be considered is, "upon any agreement that is *not* to be performed within the space of one year from the making thereof". This section does not often affect the subject, but if there is an agreement that on the face of it shows it would not be performed within the space of one year, the section applies. The particular case in which a building contract must be in writing by virtue of the Statute of Frauds is where it is within the above section five, (old section four), as being an agreement *not* to be performed within a year. This section only applies where performance *must* of necessity extend beyond the space of one year or where the agreement clearly shows on the face of it that the parties contemplated that performance should so extend. It is interesting to note that the case deciding this point was decided in 1693; *Peter vs Compton (1693) Skin. 353.* The Statute of Frauds has stood the test of time from the reign of Charles II.

R engaged B as an accountant for one year. B was engaged on Saturday but was not to commence work until Monday. The Court said this was an agreement *not* to be performed within the year and therefore was not valid; *Brittan vs Rossiter (1878) 11 Q.B.D. 123.*

A contract with a builder for building or a contract for the employment of an architect, engineer, or surveyor, for any of his ordinary duties, is a contract for work and labour and not for the sale of goods, except that a contract for the preparation of plans would seem to be a contract for the sale of goods. Contracts for work and labour have been held not to be contracts for the sale of goods and therefore need not be in writing.

The distinction between a contract for the sale of goods and a contract for work and labour was explained by Mr. Justice Blackburn, in *Lee vs Griffiin,* as follows: "If the contract be such that it will result in the sale of a chattel, the proper form of action, if the employer refuses to accept the article when made, would be for *not accepting*, but if the work and labour be bestowed in such a manner as that the result would not be anything which could be said to be the subject of sale, then an *action for work and labour* is the proper remedy."

C contracted to print a second edition of Y's book, and C was to find the materials, including the paper. The Court held that this was a contract to do work and labour; *Clay vs Yeates (1856) 1 H. and N. 73.*

A dentist was employed to make a set of teeth. The Court said this was a contract for the sale of a chattel and not one of work and labour; *Lee vs Griffin (1861) 1 B. & S. 272.*

Effect of Statute of Frauds as to Variation and Parole Evidence

As nearly all building contracts are in writing it usually makes but very little difference whether or not they come under the Statute referred to, except as regards variation and alterations and as to the admission of parole evidence. By parole evidence is meant verbal evidence. An ordinary written contract may be varied or dissolved by parole between the parties at any time before breach, but a contract required to be in writing under the Statute of Frauds cannot be varied orally. It was long ago decided that such contracts might in equity be waived or wholly rescinded by parole agreement. The question in such cases is, "What was the intention of the parties? Was it to completely rescind or merely to vary the agreement?" For an invalid attempt to vary will not amount to a rescission or abandonment of the contract; *Sanderson vs Graves (1875) L.R. 10 Ex. 234.*

Industrial Plants and their Location

A general survey of the Principal Features to be considered in Locating, Designing, and Constructing an Industrial Plant.

F. Theo. Gnaedinger, A.M.E.I.C.

Paper read before the Sault Ste. Marie Branch, The Engineering Institute of Canada, March 2nd, 1922.

Now-a-days there is a need for engineers who can do more than merely plan and design buildings to hold certain machinery or to fulfil the requirements of certain lines of manufacturing or fabrication. This need is being met by a branch of the engineering profession known as "industrial engineering". An "industrial engineer" will not only plan the layout of the buildings and equipment for an industrial unit with its accessories, that is what we may call "the plant", but the very industry itself will be planned, tested and tried out; the sources of its raw materials ascertained; the most favourable location of the industry chosen; the enterprise promoted, organized and financed; the organization and industrial relations of the employees provided for; and sometimes even the extent of a probable market investigated. In a few words, the "industrial engineer" will undertake the planning, organization, financing and construction of an industrial unit from its conception as an idea to its realization, an accomplished fact.

It is the purpose of this paper to outline some of the principal factors involved in the location of an industrial unit, or plant, and the general duties of the engineer engaged in designing and constructing it. No attempt has been made to deal directly with the organizing and financing sides of this problem.

Location of an Industry.

There is one influence on the location of an industry which does not often bear directly upon the problem confronting the engineer in his choice of a site for a plant, and that is the "migration of industry". By this expression is meant the tendency, from a geographical point of view, for certain kinds of manufacturing to shift their centres to new fields; sometimes on account of changes in methods of manufacture or sources of power, and sometimes on account of new requirements or openings for raw materials or finished product. The trend of migration is determined by the foresight of individual proprietors and is more within the distinct field of business than of engineering. This last remark might be qualified by the statement that engineers could properly be called upon to forecast future requirements or influences acting upon the probable trend of migration. Apart from this consideration the location of an industrial unit usually involves, first, the choice of some large district within which to locate the plant, and second, the selection of the actual site itself.

Choice of District.

The following factors, in varying combinations, influence the engineer in his choice of a district within which to locate an industry: (a) Proximity to materials, (b) proximity to markets, (c) adequate power, (d) favourable climate, (e) a supply of labour, (f) capital available for the enterprise, (g) transportation facilities.

Generally speaking, the most advantageous combination of these factors is such that the sum of the cost of raw material delivered at the plant, the cost of manufacture, and the cost of marketing is at a minimum. Of course this statement applies in some of its details to the final choice of the site, but it applies more particularly in the first place to the choice of a district. It may further be noted that the influences of materials and markets grow smaller as the question of transportation becomes less, economically.

In Table I are shown the principal points to be studied in selecting the district in which to locate the plant. It is by no means exhaustive but it covers the ground in a general way.

TABLE I.

Points to be studied in Making Choice of a District.

Raw Materials:

Proximity to supply of principal materials; Abundance of supply; How laid down; Proximity to feeding industries.

Markets:

Domestic; Foreign; Nearness of competition.

Power:

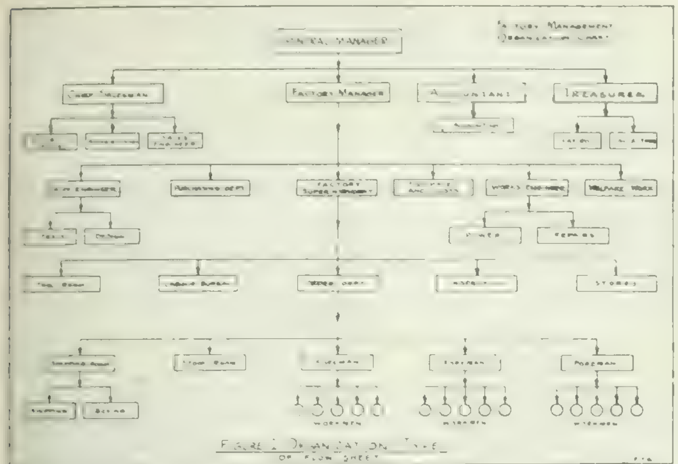
Proximity to supply of coal and oil for fuel; Cost of these laid down at plant; Natural condensing facilities afforded; Possibilities of water power development; Supply of electric power and cost.

Labour:

Sources of supply: Men, Women; Character of supply: Native, Foreign, Skilled, Unskilled; Current standard of wages; Extent to which supply is unionized; Attitude towards employers, strikes, etc.

Transportation:

Rail lines available; Navigable water courses; Street railway accommodation; Suitability of highway for motor trucks; Rates obtainable.



Raw materials must be secured in abundance and near enough to the plant, or district, so that the cost of their transportation is not prohibitive. It must be possible to regulate the supply so that it will always meet the requirements of the plant without the provision of expensive storage accommodation. Another point to be considered is the proximity of feeding industries, that is, industries supplying materials or parts required in important quantities by the proposed industry. Domestic and foreign markets must be considered in their relation to the output of the plant, and the nearness of competition reckoned with. The relative merits of the different kinds of available power, or sources of supply, usually involve a comparative study of the costs of purchasing and of manufacturing electrical energy. The main points to be considered are listed in Table I. A supply of labour must be procurable which will meet the customary requirements of the industry. In case every other condition is favourable for the establishment of the industry except that of the labour supply, it may be necessary to take steps to bring in the labour and supply living accommodation. When climatic conditions are unfavourable it will be necessary to do as much as possible to ameliorate their effects and possibly to add extra inducements in the form of high pay or long vacations. Transportation has already been touched on briefly. The main points on which information should be gathered are shown in Table I.

It is assumed throughout this paper that sufficient capital is available to finance the establishment of the industry, and that the engineer's chief concern from a money point of view is to secure the greatest value he can for the dollars expended on the project.

Choice of Site.

When a choice has been made of the district in which to establish the industrial unit there arise further considerations which influence the choice of the site itself. There are three types of locality from which to choose the site, namely, city, suburban, and country. The first usually proves the greatest attraction to the small plant and the second to the medium-sized plant. Country locations possess the largest attraction and the fewest disadvantages to the very large plant provided an adequate supply of labour can be obtained.

Among the many considerations governing the selection of the site itself may be noted the following: (a) Transportation facilities; (b) initial building requirements and possible expansion; (c) dependence on other industries; (d) local labour supply and living conditions; (e) relative value of community restrictions and community aid, legal points; (f) financial considerations; (g) relative value of local markets.

Table II gives a more extended list of the details upon which it is desirable to secure information when making a choice of the site.

TABLE II.

Points to be Studied in Making Choice of a Site.

Site:

Initial cost of land; Cost of additional land; Proximity to switching facilities; Accessibility to workers; Healthfulness; Suitableness of topography; Nature of sub-soil; Proximity to supply of building materials; Natural water supply; Advertising value.

Public Improvements:

Water supply; Sewage disposal system; Fire protection; Good roads.

Environment:

Healthfulness; Living accommodations; Schools and churches; Facilities for recreation and amusement; Community standards; Law enforcement.

Legal Points.

Laws and local ordinances; Character of local government; Tax rates.

Financial Aid.

Inducements: Bonus, Free site, Tax remittance; Co-operative capital available; Banking accommodations; Rates on water, electricity, gas, etc.

It is highly probable that in studying the data gathered, as suggested in Tables I and II, there will be several alternative sites present themselves for a final examination and comparison. The work and duties of the engineer in making his choice of the final location, and in planning, designing and constructing the plant, will now be outlined in a general way. The various steps in the procedure are given as numbered items under the three divisions of location and planning, detail work, and construction work.

Location and Planning.

1—Prepare and compile data as to present and future demands. Decide upon the objective of the proposed scheme.

2—Prepare estimated "demand curves".

3—Determine main features of operation and the probable nature of the equipment which will be suitable. What kind of raw materials will probably be best, what second choice. What will be the disposal of intermediate (if any), final and by-products, also of waste materials.

4—Collect data as to any plants for similar service that have recently been installed and compare with proposed plant.

5—Decide from "demand curves" the equipment now necessary and what extensions will probably be required in future.

6—Prepare in detail an ideal "flow-sheet" of equipment and processes.

7—Decide upon an ideal location.

8—Make an ideal layout of intended plant.

9—Determine how much land is required from a study of items 7 and 8.

10—Select properties available, (as outlined in tables I and II).

11—Prepare alternative schemes for selected sites. Make approximate estimates of costs of each, covering constructing, installation of machinery and equipment and operation.

12—Consider alternatives offered under item 11. Possibly make revised layout embodying best features of different schemes.

13—Prepare definite costs for selected site.

14—Report as to returns on investment required for project.

15—Is the owner prepared to make the expenditure?

16—Revise scheme if necessary.

17—Prepare general plans as a basis for detail work.

Flow-Sheets.

The nature and extent of the business, or process, which is to be carried on having been decided upon, it is next necessary to make studies of it in order to determine the quantities of raw and other materials which will be required, the machinery to be installed, the size of the buildings and grounds necessary to accommodate them, and also to provide for future extensions. This step in the planning is very often facilitated by means of a "flow-sheet", as indicated in item 6 above.

It is not necessary here to give a statement of the advantages to be derived from the use of diagrams for expressing data or other information. Probably one's first acquaintance with the graphic expression of facts

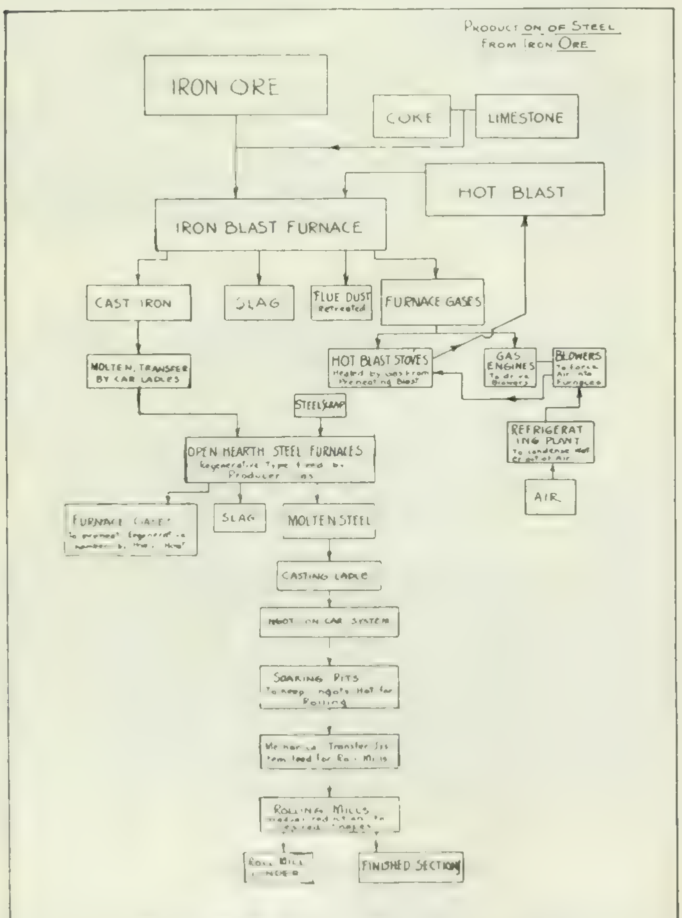


Figure 2. Process of Operations Type of Flow Sheet

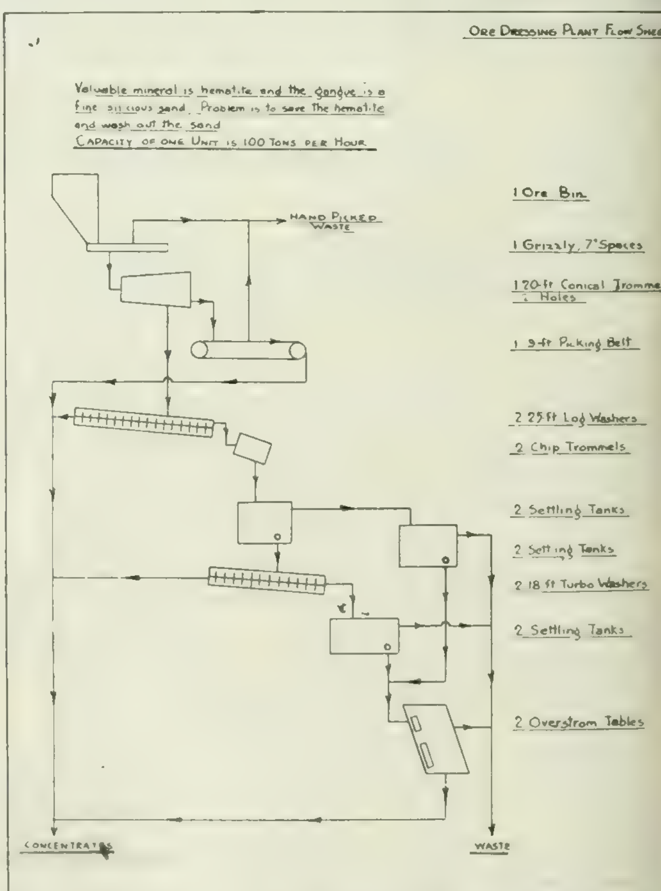


Figure 3 Machine Type of Flow Sheet

was in school history where the genealogical tree was used to show the succession and families of kings and queens.

The general purpose of a "flow-sheet" is to give, in the form of a diagram, an outline of the continuous steps in some method of treatment, or some process in industry. The origin of the word itself is probably to be found in ore-dressing where it is found in its widest use. Generally speaking, the word is there used to describe the diagrams which show the different machines and steps in a specific ore treatment, all arranged in order, and the path followed by the ore passing through them. However, it is now commonly in use to describe similar diagrams in other industries.

There are various types of these diagrams, or flow-sheets. Some give an outline of the organization of officers and employees of an industry, or of a process or series of operations carried on therein, while others give a layout of the machines or pieces of apparatus. Then again there are various combinations of these different types. Capacities and sizes of machines or equipment, quantities of materials added or taken away in a process, the cost of the different steps in a process; all these are sometimes found in "flow-sheets". Figures 1 to 4 inclusive, show simple examples of some of the principal types of flow-sheets.

The basic idea of the form and use of a flow-sheet is capable of being developed and utilized in an infinite number of ways. Besides their value as a graphic expression of a process or a series of stages in the development of some product of industry, they have a use in engineering design as well. From a simple flow-sheet, showing the steps in a process, may be prepared a more complex flow-sheet showing the continuity in the arrangement of machinery and other equipment. From this latter the engineer can prepare the general plans and typical cross-sections which will show the layout of the plant and the elevations of the different floors in it. It is also useful in preparing studies of the layout, connections and elevations of machinery and other equipment; the mechanical handling of materials; the floor areas, elevations and heights of buildings; the storage spaces for raw materials and supplies; and the necessary transportation facilities which must be provided.

Detail Work.

It is no simple matter to outline a scheme to cover the detail work connected with planning plants in general since practically every kind differs materially from every other kind, but the following one covers the ground in a general way. Plans and specifications together with all necessary contracts must be prepared for:

1—Main machinery and equipment.

2—Auxiliary machinery and equipment.

3—The power plant. Power transmission equipment and machinery for different kinds of power: mechanical, electrical, etc.

4—Boilers, boiler-room auxiliaries, mechanical stokers, mechanical draft, stack, etc. and all boiler-room equipment.

5—Coal and ash handling equipment.

6—The buildings proper.

7—Foundations for walls, special and heavy machinery, etc.

8—Mechanical handling devices and equipment, stock-yards, storage facilities, etc.

9—Water supply, lighting, sanitation, heating, ventilating, etc.

10—Roads, sidings and approaches and other transportation facilities.

11—Repair shops, stores, buildings, offices, laboratories, etc.

12—Safety devices and welfare work.

Under different sets of conditions it may be expedient to vary the order of carrying on the detail work as outlined above. In some cases a number or all of the items may be handled concurrently. One point should be especially noted in connection with item 12. In drawing up the plans care should be exercised at all times to make all machinery, equipment and buildings conform to the best "Safety First" practice.

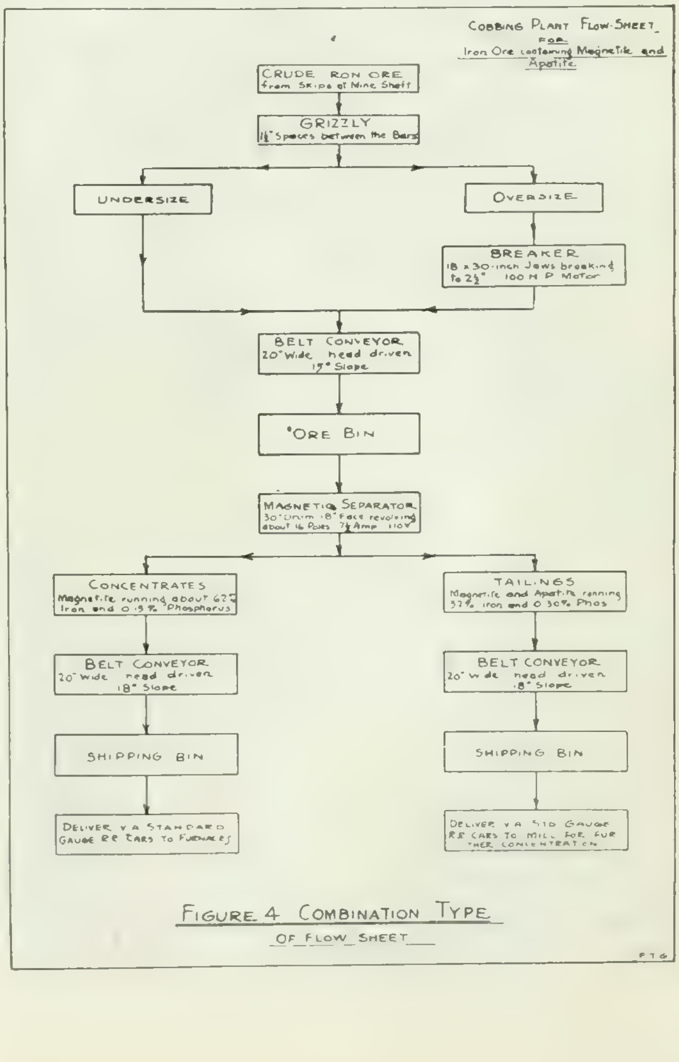


Figure 4 Combination Type of Flow Sheet

Construction.

Then follows the third stage, construction work. Under ordinary conditions the engineer will act somewhat as follows:—

1—Select firms which are to submit tenders upon the work.

2—Issue plans, specifications and copies of contracts to selected tenderers.

3—Receive and open bids.

4—Tabulate and compare tenders.

5—Let work to successful tenderers.

6—Superintend work while in progress as required by professional responsibility, understanding with owner and terms of contracts.

7—Check work as to quality and amount.

8—Issue certificates to contractors for payments by owner after completion of work, or portions of the work.

The contracts involved in the completion of the project may be drawn up in a number of different ways. The work may be done by contract for a fixed sum, or on one of the several "cost-plus" systems. The latter form generally requires more superintendence, inspection and checking by the owner or the engineer than the former, but it is very frequently considered more satisfactory and economical in the long run.

When the work is carried out on a cost-plus basis the conditions of the contract quite often reserve for the owner free access to all construction records and books; final judgement on the placing of all orders for material and equipment; and the control and direction of the general policy of carrying on the work. Customarily most of these duties are performed by the engineer or the owner's representatives.

Most of the points which must be kept track of by the engineer when the construction work is performed upon a "cost-plus" basis are covered by the details listed in Table III.

TABLE III.

Points to Observe in Handling Construction.

Schedules for:

Operations; Deliveries; Installations; Completion by units; Inspections.

Bids and Contracts for:

Equipment and machinery; Construction details; Entire buildings; Material; Installation of fixtures for: lighting, ventilation, sanitation; Decorating; Cleaning up.

Inspections of:

Buildings; Fixtures; Equipment and machinery; Material: at market, at grounds.

Cost Records to Include:

Preliminary investigations; Planning; Fees: legal, engineering; Inspection services; Construction insurance; Labour; Material; Testing; Decorating; Cleaning up.

There are many other interesting topics which might be touched upon in a paper of this nature, for example, the arrangement of plants, plans for future extensions, etc., but time limits prevent going any further into this subject.

A hasty survey has been made of the broad field of "industrial engineering". Some of the principal features governing the selection of a site for a plant have been touched upon and an outline presented of the chief duties of the engineer designing and constructing the plant. The promoting, organizing and financing of the industry not infrequently come within the field of the larger professional engineering firms, but these subjects are another phase of engineering and have not been considered to be within the scope of this paper.

The Self-Corrosion of Buried Lead Pipes

An Investigation into the corrosion of buried lead pipes in Winnipeg and vicinity, with Laboratory Experiments on the self-corrosion of lead.

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and

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Paper read before the Winnipeg Branch, The Engineering Institute of Canada, April 6th, 1922.

(Continued from the June 1922 issue, "The Engineering Journal")

Laboratory Experiments

In August 1920, experiments were started in the laboratory to ascertain the effect on lead pipe when immersed in solutions of various salts and in several typical examples of strongly alkaline soil. In about four months time, examination disclosed the fact that appreciable corrosion had started in all three of the soil samples and in the solutions of sulphates, carbonates and bicarbonates The fact that the corrosion was appreciable naturally caused the continuation of the experiments, which lasted until October 1921, with the samples which showed the most marked attack.

Lead plates, exposing about 37.5 sq. cm. of surface, were placed in salt solutions and soils, in glass beakers, on August 23rd, 1920. They were kept at a temperature of 80°C until September 10th, and the first weighings were made on September 12th. After this time they were kept at room temperature. The water lost by evaporation was replenished by adding distilled water from time to time. They were taken out and weighed again on December 13th 1920, after which they remained in the beakers, as before, until October 4th, 1921, when the final weighing was made. Table B below, gives the losses indicated at these successive weighings.

Table B.—Loss in Weight of Lead Plates placed in Salt Solutions and Soils.

Salt Solution or Soil	Loss in Grams			
	Aug. 23rd to Sept. 12th	Sept. 12th to Dec. 13th	Dec. 13th to Oct. 4th	Total Loss
$CaCO_3$	0.060	0.021	0.239	0.320
$Ca(HCO_3)_2$	0.090	0.010	0.110	0.210
Na_2CO_3	0.104	0.113	0.598	0.815
$MgSO_4$	0.116	0.016	0.206	0.338
Soil-Manitoba Gypsum Works	0.029	0.018	0.191	0.238
Soil-Glasgow ave., Winnipeg	0.009	0.005	0.590	0.604
Soil-Stock yards St. Boniface	0.009	0.003	0.239	0.251

The plate immersed in the $CaCO_3$ solution had an accumulation of lead carbonate where the plate was in contact with the glass of the beaker.

The plate in the Na_2CO_3 solution was covered with a mass of glistening white flat scales, consisting apparently of a carbonate of lead. Under the microscope the surface of the plate showed innumerable pits where the corrosion had taken place. The surface of the plate immersed in the $Ca(HCO_3)_2$ solution was covered with a black coat at first, and a very little adhering carbonate of lead was observable during the first eight or nine months. The surface of the plate in the $MgSO_4$ solution was covered with a thin coating of lead carbonate. Evidently the CO_2 of the air dissolving in the water, was the cause of the final end product of carbonate of lead.

The most striking result of this series of experiments is to be seen in the rapid increase in the rate of corrosion with the lapse of time. The one exception to this is the $Ca(HCO_3)_2$ solution, where the lead was covered with a protective coating of black oxide of lead.

It is most remarkable to observe the great increase in the corrosion of the plate buried in the Glasgow avenue soil. The loss here was more than double that in the other two soil samples and second to that of the Na_2CO_3 solution. This fact, observed in the laboratory, tallies with the very remarkable conditions observed in the corrosion of pipes on Glasgow avenue. During the past five years there have been fourteen cases of lead pipe corrosion in one block on that avenue, adjacent to Osborne street. Half of these occurred before the system was changed to three-wire operation in March 1919, and the other half have occurred since that time, there having been repeat cases on five of the pipes, though not necessarily at the same spot. A careful examination was made of the polarity of this water main last summer, with the delicate galvanometer and testing terminals above mentioned, and it was quite clear that the result of three-wire operation of the electric railway, which had been continuous for over two years, was to cause the polarity between pipe and earth to oscillate constantly, at least as often as once every minute or two, between positive and negative, with the majority of readings negative. The soil of Glasgow avenue is of the same light coloured limy silt so frequently found to be present where lead pipes are corroded. The locality is nearly half a mile from the

nearest substation. In this connection it may be of interest to note that four different analyses of ground water from Glasgow avenue showed the following weight of free CO_3 per 100,000 grams of ground water:— 26 grams, 43.2 grams, 129.6 grams and 54 grams; or an average of 63.2 parts per 100,000 of the CO_3 radical alone.

This may not mean that the carbonic acid of itself starts the corrosion, but its presence causes the lead hydrate that has been formed in the original solution to be changed to insoluble lead carbonate, leaving the soil solution relatively free from lead ions and ready for further attack upon the lead. Thus the fixing of the lead hydrate as carbonate tends to continue the auto-electrolytic corrosion of the pipe.

Besides the above experiments upon lead with soils and salt solutions, some experiments were made with lead as the anode, and as the cathode, of an electrolytic cell.

Corrosion of Lead Anodes

Three experiments were performed with lead anodes and cathodes immersed in saturated soils contained in beakers. Through these, ten milliamps were run continuously for three days after which the series was discontinued owing to the disintegration of the anodes. A mixture of lead oxide and lead peroxide formed at the anode and the plates became badly pitted, some of the lead falling away mechanically. The loss at the anode was far beyond that required by Faraday's Law. The cathodes were not attacked, but a coating of carbonate formed on their surfaces. The results of the series are contained in Table C below:—

Table C.—Loss Sustained by Lead Anodes in 72 Hours with 10 Milliamps Current.

Soil Sample	Weight of Cathode in grams		Weight of Anode in grams		Loss at Anode in grams	Percentage loss of theoretical
	before	after	before	after		
Manitoba Gypsum Wks.	61.567	61.570	70.555	66.400	4.155	150%
Glasgow street.	71.291	71.300	76.023	70.170	5.853	210%
Stockyards ...	61.807	61.809	57.034	47.360	9.674	350%

It will be noticed that the corrosion of lead by electric current is exceedingly rapid, nearly 10 grams of lead being dissolved by 10 milliamps, or 0.01 ampere, in three days time in a representative sample of alkaline soil. The fact that the actual loss is from 150% to 350% of the theoretical loss, is fairly good proof of the futility of attempting to apply theoretical "coefficients of corrosion" in estimating the life of a buried pipe exposed to electrolytic conditions, where it may be possible to have five or more different compounds of lead in the end products, as will be shown later. As the electrolytic disintegration of the anode proceeds, with the possible formation of a variety of end products, the mechanical disintegration must also be very greatly increased due to the volume changes within the mass of the lead anode, by reason of the expansion of these products which occupy more space than the original lead. This may account for the very great increase of the actual over the theoretical loss.

An examination was also made of the theory that in an alkaline soil a lead cathode will react with the supposedly existent alkaline hydrate to form lead hydrate, which ultimately becomes lead carbonate, the lead cathode being in this case as subject to corrosion as if it were an anode. These cathode experiments and results are as follows:—

Corrosion of Lead Cathodes

Lead cathodes and carbon anodes were immersed in salt solutions. A current of between 4 and 10 milliamps was continuously passed through the solutions for sixty days during which time about 38,000 coulombs flowed through the circuit. The carbon anodes were badly corroded and in the case of the chloride solutions, free chlorine was evolved and the solutions became saturated with the gas. Gas was evolved at both poles in almost all cases, being most marked in the magnesium sulphate and sodium carbonate solutions. Colloidal carbon was formed in the magnesium sulphate and sodium carbonate solutions.

The cathodes were covered with a more or less loosely adhering coat of carbonate, excepting that in the solution of magnesium sulphate the cathode was covered with a coating of finely divided carbon only. After removing these superficial coats it was found that the cathodes had sustained very little, if any, loss. It was found difficult to remove the scale without taking off some of the lead, so that the small losses listed in Table D below, may or may not be real losses. They are of the same order as the losses found by the action of salt solutions acting alone, given in Table B.

Table D.—Loss sustained by Lead Cathodes, exposing 37.5 sq. cm. surface with Carbon Anodes and a Current varying from 4 to 10 Milliamps. Time 60 days.

Salt Solution	Weight of cathode in grams.		Loss in Grams
	Oct. 15th	Dec. 15th	
Na_2CO_3......	73.705	73.680	0.025
$Ca(HCO3)_2$....	63.170	63.140	0.030
$MgCl_2$........	63.891	63.770	0.121
$CaCl_2$........	72.090	71.944	0.146
NaCl.........	73.952	73.927	0.025
$MgSO_4$.......	63.240	63.240	0.000
$CaCO_3$.......	72.717	72.702	0.015
$CaSO_4$.......	72.733	72.720	0.013

From the foregoing experiments we derived assurance first, that even where no stray current is present, corrosion in soils containing soluble salts, especially carbonates, is inevitable; second, that lead anodes in soils containing soluble salts corrode with extreme rapidity; third, that lead cathodes in salt solutions and in soil do not corrode appreciably more in the same time with a current density of $\frac{3}{10}$ milliamps per sq. cm., than in salt solutions, or in soil, without stray current.

The Action of Salt Solutions on Lead in the Presence of a Soluble Nitrate

Whenever the subject of lead electrolysis has been discussed, reference is nearly always made to the assumed presence of nitrate in the soil as an electrolyte that promotes stray current corrosion. This suggests the possibility of a nitrate promoting self-corrosion, because of the known solubility of lead in nitric acid. The following experiments were made in order to throw some light, if possible, on the corrosive influence really exerted by nitrates in the soil.

It should be remarked that the presence of nitrate is an elusive sort of condition. The commonest supposed source of nitrate is the decomposition of organic matter. The presence of nitrifying bacteria is known to cause nitrates to be formed out of the organic matter in the soil. As soil conditions are liable to constant change with the circulation of ground water, and all nitrates are highly soluble, it is not so easy to tie up nitrates to participation in a given case of corrosion, as it is the solutions of salts originally inorganic, like the sulphates, chlorides and carbonates, whose presence is so self evident in the soils of this locality.

Normal tenth solutions of the below listed salts were prepared and pieces of lead exposing 60 sq. cm. of surface were immersed in 400 cu. cm. of each solution. To each was added one gram of ammonium nitrate. The bottles were kept tightly corked at room temperature from February 2nd until September 16th. The plates were then removed from the solutions, cleaned, and weighed. The results are given in Table E.

Table E.—Action of Salt Solutions on Lead in the Presence of a Soluble Nitrate.

Salt Solution	Weight Feb. 2nd	Weight Sept. 16th	Loss
Saturated $CaSO_4$	49.235	49.180	0.055
Saturated $Ca(HCO_3)_2$	49.509	49.180	0.329
$\frac{N}{10}$ $MgCl_2$	49.668	49.430	0.238
$\frac{N}{10}$ MgSO	47.412	47.260	0.152
$\frac{N}{10}$ $CaCl_2$	47.220	46.950	0.270

In every case the surface was covered with a coat of black oxide of lead of varying thickness. This coat was very heavy on the lead plate immersed in the $MgSO_4$ solution and quite thin in the case of the $CaCl_2$. Spots of $PbCO_3$ with pits beneath were very marked on the plate immersed in $Ca(HCO_3)_2$. The damage was slight in the case of the $CaSO_4$, a few little nodules of $PbSO_4$ having formed here and there over the surface. Where the plate touched the glass in the $MgCl_2$ and $CaCl_2$ solutions a heavy deposit of mixed lead carbonate and chloride formed. Deep pits were found beneath these incrusted spots.

Apparently the corrosion in the presence of ammonium nitrate during a relatively short exposure is not of noticeably different order than with the salt alone, although it would doubtless take considerably more experimenting to establish any very definite relation. The formation of the protective coating of black oxide of lead is probably due to the presence of the nitrate as it is an oxidizing agent. After cleaning and weighing, the plates were returned to their respective solutions and almost immediately a black deposit formed again over their surface. Some four or five months subsequently, it was noticed that white deposits were rapidly gathering on the plates, those in the calcium salts showing the heaviest incrustations, especially the sulphate and bicarbonate. The absence of corrosion at first, and its presence subsequently, make this experiment somewhat inconclusive as to the inhibitive effect of a nitrate.

In order to obtain quick action and visible evidence of corrosion both in salt solutions and soils, and especially to examine the effect of the contact of lead with two soils of a different character as a condition that would possibly promote corrosion, strips of lead foil, as well as some lead plates, were exposed to corrosive actions as indicated below. The results were not gauged by weighing but by the appearance of the samples after they had been under treatment from the middle of February until the first part of October.

The Corrosion of Lead Foil in Salt Solutions

Five strips of lead foil were immersed in 400 cc., of the same salt solutions as described in the preceding experiment, the same quantity of ammonium nitrate being added. The strips were mounted on paraffin wax plates. The strips were immersed February 2nd 1921. It was expected that corrosion would show itself by the perforation of the lead foil and this actually happened to the foil immersed in the $Ca(HCO_3)_2$ solution, in July. By October 4th the perforation had spread over a considerable area of the foil. The foil in the $CaCl_2$ and $MgCl_2$ was also badly attacked but the perforations were not nearly so general as with the bicarbonates of calcium. The foil immersed in the sulphates of calcium and magnesium were the least attacked. In every case the lead was covered with a black coat of oxide. Had this experiment been performed without the addition of the nitrate, perforation of the foil would possibly have occurred earlier.

The Corrosion of Lead Plates and Lead Foil in Soils

Three lead plates and four wax-supported strips of lead foil were buried in moist soil and left undisturbed for several months. The plates and strips were about six inches long and two inches wide. They were placed vertically in glass tubes and the soil packed in around them. The tube was tightly corked at both ends. Each tube contained two samples of soil, the upper end of the lead being in one kind of soil and the lower end in a soil from another locality.

No.	Lead	Soil above	Soil below
1	foil	Glasgow street	Kennedy and Broadway
2	"	Edmonton street	Surface soil Jubilee and Daly
3	"	St. James	River Park
4	"	River Park	Sand under pavement, Archibald st.
5	plate	Surface, Jubilee and Daly	Edmonton street
6	"	C. P. R. Shops, Weston	Jubilee and Pembina
7	"	Assiniboine ave.	Selkirk

The lead foil and plates remained in contact with the soil from February 5th until September 9th, with the one exception of No. 6, which was examined June 22nd.

No. 1. Lead foil badly attacked at the upper end, completely perforated. Lower end also corroded and blackened.

No. 2. All foil beyond end of wax completely destroyed. Lower end of foil also badly corroded.

No. 3. Corrosion completely through at upper end and lead disappeared. Lower end also perforated. White lead salt formed.

No. 4. Both ends where surrounded by soil completely destroyed. Elsewhere perforations especially where the soil found its way between the wax and the foil.

No. 5. Lead plate pitted deeply in portion buried in surface soil. Pits $\frac{1}{32}$ inch deep or more. $PbSO_4$ incrusted over pits.

No. 6. Slightly incrusted but not badly attacked.

No. 7. Badly corroded and incrusted. White incrustant of lead carbonate $\frac{1}{32}$ inch thick on both sides of upper end of lead strip. Lower end not so badly attacked. No sulphate.

The results of this series of experiments was decidedly illuminating. They established without doubt the corrosion of lead by the action of the soil alone. The nature of this corrosion was quite similar to that observed on the lead service pipes in various parts of the city; the same crater-like cavities, covered by a white incrustant of lead sulphate or carbonate. The extent of the corrosion was quite remarkable. In seven months time pits nearly $\frac{1}{32}$ inch deep were formed.

Summary

(1) Salt solutions attack lead forming the carbonate of lead when exposed to the air.

(2) The carbonate of soda is the most corrosive of the salts experimented with.

(3) The presence of ammonium nitrate seemed to inhibit initial corrosion by the formation of a protective coating of lead oxide over the surface, but this inhibitive action may be only temporary.

(4) The soils of the Winnipeg district have a decidedly corrosive action on lead, the nature of the corrosion being that of a crater-like pitting of the surface with a deposit of lead sulphate or carbonate in the neighborhood of the pitting.

The Chemical and Physical Peculiarities of Lead

Lead belongs to a group of metals possessing characteristics that in chemistry are termed "amphoteric", which means that it has a sort of dual character as regards its reactions with acids and bases. The monoxide of lead, PbO, is quite basic in character and readily combines with water forming lead hydroxide, $Pb(OH)_2$, from which carbonates and sulphates of lead are readily formed. This hydroxide gives an alkaline reaction in water.

The brown oxide of lead, PbO_2, or lead dioxide, is somewhat acidic in character, forming a series of salts with the more strongly basic metal, like sodium, potassium and calcium, which salts are known as plumbates. Thus we have sodium plumbate, Na_2PbO_3, and calcium plumbate, $CaPbO_3$. In this way lead is capable of acting as a base, then forming a series of salts such as lead nitrate, lead carbonate, lead sulphate etc., or it may be found as part of the acid radical forming with another metal a series of salts like the plumbates. This lack of definite basic or acidic characteristics makes the metal a tool of its environment. It may be expected to act basic if in an acidic environment, and acidic if in a stronger basic environment.

Lead is relatively insoluble in hydrochloric and sulfuric acids, but is readily attacked by nitric and acetic acids. Certain other organic acids will corrode lead. A coating of oxide readily forms upon the surface of metallic lead, which is commonly believed to protect it from corrosion. This coating, however, is actually soluble in water, the more so if the water be quite pure or if it carries much oxygen in solution. The sulphate of lead is slightly soluble in water and the carbonate much less soluble so that, in the presence of the acid radicals of sulfuric and carbonic acids, the lead hydrate is easily transformed into carbonate or sulphate, and the sulphate may be transformed into the more insoluble carbonate.

According to several authorities, lead has a peculiar physical property of occurring in more than one physical modification, even in the same piece of metal, and these allotropic modifications may occur quite near together in the same metal. These variations of the physical structure of the lead possess different physical and electrical properties and these differing properties may persist for a long time. Consequently adjacent portions of lead in the same piece of metal may set up a galvanic couple when in contact with an electrolyte, and provide all the conditions required for electrolytic self-corrosion. This property of lead has been investigated by Messrs. Lambert and Cullis, (see Journal of the Chemical Society, 107-210, 1915,) who have observed as follows:—

> "The electrolytic theory of corrosion is applicable to lead. The passing of the metal into solution which precedes corrosion is due to electrolytic action between the electrically different parts of the mass of lead. In the case of chemically pure lead, the physical heterogeneity due to the presence of different allotropic modifications of lead in the mass of the metal, causes some parts of the mass to be electrically different from other parts, and these electrical differences persist for a long time after the preparation of the metal."

The practical effect of this allotropic property of lead is met with in practice by users of lead pipe. This property was observed, for instance, by the engineer of the Mental hospital at Selkirk, who exhibited a piece of lead pipe taken out of the earth, where it had been buried for some years, which he said had "lost its life". That is to say it was very brittle, had a different appearance from ordinary lead, and was no longer suitable for being worked.

Messrs. Lambert and Cullis found that the purest lead that it was possible to produce by distillation in a vacuum was immediately corroded when immersed in water containing oxygen. The first product of corrosion

under such circumstances is evidently lead hydrate, which, when there are no other salts present, will appear as a precipitate. It has also been ascertained by a number of observers, that hydrogen peroxide is formed when lead, water, and oxygen are brought together. This is a strong oxidizing agent and accordingly might well account for the presence of the higher oxides of lead which are sometimes found amongst the corrosion products of lead pipe. Several such transformations of lead have been observed. A lead union from a service pipe in Moose Jaw, Saskatchewan, sent in for examination, was found to be almost wholly transformed into a red oxide of lead. A similar case was shown by A. Blackie, city chemist of Winnipeg, in which a considerable portion of a piece of lead pipe consisted of a red oxide of lead. Black oxide of lead was also observed on service pipes from River and Glasgow avenues in Winnipeg. The corroded lead pipe taken from Selkirk had an insoluble lead compound sticking to the matrix of clay that surrounded the pipe, which was probably lead peroxide. There was not enough of it to make an analysis.

L. A. Stenger, in Chemical and Metallurgical Engineering, May 1920, attributes the soil corrosion of lead pipes as observed by him to two probable sources: (1) The action of a concentration cell produced by differences of concentration of a salt in the soil in contact with the pipe, and (2), the presence in the soil of a substance subject to a change in valence, the bi-electrolyte causing corrosion in the cathode areas. The first of these two causes is similar to that described by the authors in a former paper on the self-corrosion of cast iron. The effect on lead pipe would be practically similar to that observed on iron pipe, that is, the lead would pass into solution where the metal was in contact with the more dilute electrolyte. The mechanism of this process was indicated in diagrams in the former paper. Both of these causes of corrosion as outlined by Mr. Stenger are external to the pipe and not in any way dependent upon the lack of homogeneity in the lead.

A recent article contributed to Metall und Erz, volume 16, 1920, on the destructive action of mortar on zinc and lead, states that lead is attacked by limestone alone and by mixtures of limestone and gypsum. This is substantiated by the experiments published by Richard H. Gaines, mentioned above, as well as by the case of corrosion noted at Charlottenburg, Germany.

H. S. Rawdon in a paper published in April 1920, by the Bureau of Standards, bulletin No. 377, describes the results of a series of experiments on lead corrosion which show that the so-called allotropic modifications of lead are produced by corrosion in an electrolyte, by the solvent action of the salt solution removing the foreign metals lying between the crystals of metallic lead in the mass of the lead. Even the purest commercial lead is subject to this attack and, since the metallic impurities removed lie above lead in the electro-chemical series, this form of corrosion is quite parallel with the galvanic action brought about between graphite and iron in cast iron, when iron goes into solution and graphite remains in the pipe. In the case of lead pipe the impurities are removed and the lead in unsupported crystals remains, imparting to the pipe that characteristic crystalline structure and brittleness which eventually destroys its usefulness.

These observations of Rawdon supplemented by a later investigation*, in which he used lead of 99.99% purity subjected under tensile stress to the corrosion of salt solutions, afford an unexampled instance of the possibility of electro-chemical destruction due to the presence of almost infinitesimal amounts of an impurity in the metal structure when such a structure is in contact with water containing salts in solution. Rawdon also observed that the corrosion of lead was more rapid in an acid solution. Recent investigations in the laboratory of the University of Manitoba, (not yet published), indicate that the soil waters of Winnipeg in the presence of $CaSO_4$ and $CaCo_3$ are slightly acid especially when they contain free carbon dioxide. Moreover the function that mechanical stress plays in promoting the corrosion of lead would lead to widely diverging observations on the extent of the corrosion at different places on the same lead pipe buried in the same soil. Wherever the pipe was bent, there the pipe may be considered to be under stress, and there intergranular cracks as described by Rawdon would first appear, the rapidity of the disintegration depending on the amount of the stress and the character of the soil solution.

We thus see how complicated is the whole matter of the corrosion of lead. Not only does the peculiar amphoteric character of lead enter into it but also the physical character of the crystalline metal structure, the infinitesimal amounts of intergranular impurities present, and the stress to which the structure is subjected. These factors, combined with the complexities of the salt content of ground waters, make the whole question of the soil corrosion of lead a matter for most intensive study.

Electrolytic Theory of Self-Corrosion Fits Observed Facts.

Our experiments have established in striking fashion the self-corrosion of lead in various solutions and soils taken from Winnipeg and vicinity, this corrosion being of the same general appearance and carrying the same end products as are found on the service pipes buried in the soil here and there about the city and vicinity. It is now evident, from our knowledge of the characteristics of lead and from the known effects upon it of water containing oxygen and carbon dioxide, that, *when buried in soil containing pulverized limestone and gypsum, a lead pipe is in corrosive surroundings.* The samples of soil used in the laboratory experiments all contain a proportion of carbonate and sulphate of lime, which other experimenters have shown to be corrosive to lead. The pock-marked variety of self-corrosion so frequently observed, both on the test pieces and on service pipes about the city, suggests local galvanic action such as Lambert and Cullis attribute to allotropic modifications in the lead itself. The cavities would occur on the lead where that modification of lead having the highest electrolytic solution pressure existed, and there the metal goes into solution. But in a soil such as that underlying the city of Winnipeg, the ground water is rich in carbonate and sulphate, and the lead ions,

*Rawdon, Krynitsky & Berliner,—"Brittleness produced in pure lead by Stress and Corrosion", Chemical and Metallurgical Engineering, Jan. 1922.

travelling out with the self-generated galvanic current, soon meet and combine with these salts, forming insoluble lead sulphate and carbonate in the form of a white incrustant covering the cavity from which the lead was dissolved. Should the ground waters adjacent to the pipe be relatively free from sulphate or carbonate, the lead would likely form hydrate and this in turn would be transformed sooner or later into oxides of lead.

If the lead ions travelled an appreciable distance from the pipe before being fixed as hydrate, carbonate, sulphate, or oxide, the lead combined would be found adherent or incorporated in the soil and free from the pipe, and the pipe on exposure would be found corroded in a pock-marked manner, but not encrusted. Should the lead ions be precipitated immediately on going into solution, an adhering encrustant on the surface of the pipe would result. In the case of the lead union previously mentioned as partly transformed into red oxide of lead, this transformation had occurred in place and had changed a large portion of the wall of the pipe from metallic lead into oxide without greatly altering the external form of the pipe.

Hydrogen Peroxide Effects.

According to the work of Traube, (Zeit. Phys. Chemie 1900), hydrogen peroxide is produced when lead is acted upon by water containing dissolved oxygen. This strongly oxidizing peroxide reacts further with the oxide of lead producing progressively the higher oxides of lead. Lambert and Cullis (loc.cit.) point out that this reaction would equally likely occur in the auto-electrolysis of lead but as it is only a secondary result it does not in any way affect the course of the corrosion. The end products, however, would be the production of the orange yellow or red oxide of lead. These chemical changes would be represented by the following equations: (1) $Pb + H_2O + O_2 = PbO + H_2O_2$; (2) $PbO + H_2O = Pb(OH_2)$; (3) $Pb + H_2O_2 = Pb(OH)_2$.

Should this oxidation proceed further the PbO would be transformed into the higher oxides by the H_2O_2 as follows: (4) $PbO+H_2O_2=PbO_2+H_2O$; and if we accept the assumption of the two highest oxides as being produced from PbO and PbO_2, then (5) $PbO+PbO_2=Pb_2O_3$ (an orange yellow oxide) and (6) $PbO+2PbO_2=Pb_3O_4$ (red lead). Thus the formation of H_2O_2 would account for the transformation of the lead into the orange yellow oxide of lead or even to red lead itself. Including the hydrate, five (5) separate compounds of lead and oxygen may be formed.

On the other hand, a section of service pipe taken from No. 468 Glasgow avenue in August 1921, was corroded in the characteristic pock-marked manner, and adhering deposits of carbonate were in evidence, but the cavities were largely free from incrustations. There were also deposits of lead oxide on the pipe, varying in colour from black to red, and these deposits were in the immediate neighbourhood of the cavities. The intimate mixture was of such a nature that the pitting and the oxide formation must be attributed to a common cause. It is possibly of some interest to mention that the surface of the oxide was cracked and fissured, the cracks extending down to the metallic lead.

We thus find that the products of corrosion in the case of lead are extremely varied and are determined largely by the environment. The amphoteric character of lead, together with its intercrystalline impurities which Rawdon found to have such an important function in corrosion, provides a reasonable explanation for the variety of these products as well as for the corrosion itself.

It is evident that lead, although a nobler metal than iron and close to hydrogen in the electro-chemical series, may yet be subject to severe attacks due to slightly changing physical or electro-chemical conditions. With the soil environment that exists about the Winnipeg water-service pipes, it is possible to have a number of conditions present, any of which are capable of resulting in the corrosion products observed both in the field and the laboratory. These may be summed up as follows:—

1. Differences of concentration in the ground water solutions surrounding the pipes, initiating an electrolytic condition.

2. Contact with soil containing water having oxygen and carbon dioxide in solution is, of itself, sufficient to start corrosion of the lead. This is especially the case when the pipe is surrounded by cement, mortar, or soil containing pulverized carbonates.

3. Decomposing organic matter in contact with lead independently of other causes, provides ample means for corroding it.

4. Differences in physical structure of a lead pipe itself, which bring about different solution pressures of the lead in adjacent areas on the pipe and set up electrolytic corrosion by creating local galvanic battery cells.

5. Metal impurities lodged between the crystals of lead permit electrolytic attack of the lead along the crystalline boundaries when the pipe is subjected to ground waters containing salts in solution.

With respect to the protection of buried lead pipes from chemical attack the only practical suggestion that can be made now, is to provide an impermeable continuous and enduring waterproof coating over the lead, of a character and thickness that will not deteriorate in the presence of the substances that cause the deterioration of lead. If this coating were to consist of a thick paste of commercial white lead paint, laid on with a spiral wrapping of burlap thoroughly impregnated with the white lead, it should afford protection against corrosion from soils high in carbonates and other more soluble salts. The artificial coating of insoluble lead carbonate could not react with the CO_2, the carbonates, or with the other more soluble salts in the soil, nor could it injure the lead pipe.

Laboratory experiments have proved that corrosive reactions such as those described in the foregoing paper, are possible without any assistance from stray current. it is therefore necessary to test the polarity to earth of a buried pipe, whether of lead or cast iron, before it can be claimed that the pipe is corroded through the agency of a stray current from an outside source.

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THE

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Professional Meeting 1922

Winnipeg: September fifth, sixth and seventh.

First B.C. Professional Meeting Marked by Enthusiasm

The first British Columbia Professional Meeting of *The Institute* was held in Vancouver on June sixteenth and seventeenth under the joint auspices of the Vancouver and Victoria Branches, and proved to be one of the most enjoyable of the many successful gatherings held throughout the country by *The Institute.* The weeks of preparation by the committees in charge of the meeting, were amply rewarded in the results obtained and the Pacific Coast Branches have established for themselves a lasting name as hosts. With a programme of such exceptional engineering interest, and entertainment of a kind which can only be provided on the western coast, and favoured with perfect weather, the two days allotted for the meeting were all too short for the visiting members. One hundred and twenty-eight members registered, representing the numerous branches of the profession from coast to coast. The excellent papers and discussions and the visits to points of engineering interest created an enthusiasm which is rarely attained at so large a meeting.

The programme, which is given in detail below, contained papers of particular current interest and each paper brought forth lively discussions. Registration on Friday morning was followed by an address of welcome by His Worship, Mayor Tisdall of Vancouver. The paper on Town Planning in British Columbia, by James Ewing, M.E.I.C., of Montreal, aroused great interest and resulted in the passing of a resolution, addressed to Council, recommending that steps be taken to have the Provincial Governments take a greater interest in the movement, in parts of the country where this has not already been evidenced. The luncheon, on the first day of the meeting, was held jointly with the Canadian Club, at the Hotel Vancouver and afforded an opportunity for a social meeting of the members of the two organizations. The visit to the Ballantyne Pier during the first afternoon was arranged through the courtesy of A. D. Swan, M.E.I.C. consulting engineer of Montreal, and the Northern Construction Company, Limited, and the inspection of this important Canadian Government harbour development proved of great interest to the members and their guests. At the Friday evening session the members were given an excellent idea of the engineering features encountered in the famous logging industry of British Columbia by T. W. Fairhurst, A.M.E.I.C., of Vancouver. The paper on "Irrigation in British Columbia" by P. J. Jennings, M.E.I.C., of Calgary, which was originally planned for the morning session was presented during the evening and on account of the general interest in this subject it was necessary to delay the discussion which followed Mr. Jenning's paper until the Saturday morning session

The business meeting which was held on Saturday morning gave rise to the enthusiastic discussion of a number of very important Institute affairs and as an outcome of this discussion a resolution was unanimously passed endorsing the recommendations contained in the report of the Committee on Policy. In consideration of the Policy Committee's recommendations, it was resolved

that no action should be taken to re-establish the Provincial Division of *The Institute*. A resolution presented by the Victoria Branch advocating the co-ordination of the engineering legislation of the various Provinces was also endorsed at the meeting. Votes of thanks were tendered to the officials of the City of Vancouver; to the Canadian Pacifical Railway officials; to A. D. Swan, M.E.I.C., the Northern Construction Company, Limited and Wm. Smaill, M.E.I.C.; to Major Geo. A. Walkem, M.E.I.C., Chairman of the Social and Reception Committee; to the University Club of Vancouver for courtesies extended to visiting members; to the Automobile and Service Clubs of Vancouver and New Westminster and the Canadian Good Roads Association for their courtesy in providing sightseeing excursions; to the authors of the various papers and those leading in the discussions; and to the committees through whose able management this most successful Professional Meeting was made possible.

Programme of the B.C. Professional Meeting.

FRIDAY, JUNE 16th.

8.45 a.m.—REGISTRATION at Hotel Vancouver.

9.30 a.m.—ADDRESS OF WELCOME:
His Worship the Mayor of Vancouver.

9.45 a.m.—TOWN PLANNING IN BRITISH COLUMBIA:

James Ewing, M.E.I.C., Ewing, Lovelace & Tremblay, Civil Engineers, Montreal.

DISCUSSION:

H. M. Bigwood, A.M.E.I.C., Chief Draughtsman, Dominion Public Works Department, Victoria.

W. B. Young, A.M.E.I.C., Designing Engineer, City Engineer's Department, Vancouver.

W. B. Greig, A.M.E.I.C., Municipal Engineer, Point Grey.

11.30 a.m.—IRRIGATION IN BRITISH COLUMBIA:
Ernest A. Cleveland, M.E.I.C., Consulting Engineer to Department of Lands, Victoria.

DISCUSSION:

P. J. Jennings, M.E.I.C., Acting Assistant Commissioner of Irrigation for Alberta and Saskatchewan, Calgary.

A Representative of the Water Rights Branch, Victoria.

1.00 p.m.—LUNCHEON AT HOTEL VANCOUVER.
Special Address will be arranged.

2.30 p.m.—INSPECTION VISIT TO BALLANTYNE PIER.

This has been arranged through the courtesy of A. D. Swan, M.E.I.C., Consulting Engineer, Montreal, and The Northern Construction Company, Ltd., Contractors. The party will be in charge of Wm. Smaill, M.E.I.C., Chief Engineer, Northern Construction Company, Ltd. Water Transportation by courtesy of Geo. A. Walkem, M.E.I.C., Vancouver Machinery Depot, Ltd.

8.30 p.m.—PROFESSIONAL ENGINEERING IN THE B. C. LOGGING INDUSTRY.

Illustrated with Lantern Slides.

T. W. Fairhurst, A.M.E.I.C., Sales Engineer, Vancouver Machinery Depot, Ltd., Vancouver.

DISCUSSION:

By the Vancouver and Victoria Branches.

SATURDAY, JUNE 17th.

9.00 a.m.—BUSINESS MEETING.

There will be short addresses on the following topics:

POLICY:
W. G. Swan, M.E.I.C.

WELFARE:
D. O. Lewis, M.E.I.C.

BRITISH COLUMBIA PROVINCIAL DIVISION:
G. A. Walkem, M.E.I.C.

DISCUSSION:
As these questions are closely related, the discussion will be regulated by the Chairman.

11.30 a.m.—EXCURSIONS.

Through the courtesy of the Vancouver City Council and the City Engineer, an excursion to the Scott Ranch, Seymour Creek, North Vancouver, has been arranged, where a luncheon will be provided for the members. Following this the party will be conducted over the Seymour waterworks intake, and other features of interest.

For those who desire other entertainment, sightseeing excursions to the Lower Mainland have been arranged through the courtesy of the Automobile and Service Clubs at Vancouver and New Westminster, co-operating with the Canadian Good Roads Association.

Through the kindness of the University Club the courtesies of the club are extended to all visiting members of **The Institute** during their stay in the city.

Committee on Deterioration of Concrete in Alkali Soils Meets at Calgary

A meeting of the Committee on Deterioration of Concrete in Alkali Soils was held Monday, June 5th at 10 a.m. in the Palliser Hotel, Calgary, Alta., followed by a visit to the Eastern Irrigation Block of the Canadian

Professor C. J. MACKENZIE, M.E.I.C.
Dean of Engineering, University of Saskatchewan;
Chairman of Committee on Deterioration of
Concrete in Alkali Soils

Pacific Railway where the use of concrete in the construction of various large irrigation structures was seen.

The following committee members were present:—Professor C. J. Mackenzie, chairman, University of Saskatchewan, Saskatoon, Sask.; Professor J. N. Finlayson, University of Manitoba, Winnipeg, Man.; W. P. Brereton, city engineer, Winnipeg, Man.; Dr. J. W. Shipley, University of Manitoba, Winnipeg, Man.; A. Blackie, city analyst, Winnipeg, Man.; H. McI. Weir, assistant city engineer, Saskatoon, Sask.; A. S. Dawson, chief engineer, Department of Natural Resources, C.P.Ry., Calgary, Alta.; Geo. W. Craig, city engineer, Calgary, Alta.; F. C. Field, city analyst, Calgary, Alta.; R. S. Stockton, Dept. of Nat. Resources, C.P.Ry., Strathmore, Alta.; A. W. Haddow, city engineer, Edmonton, Alta.; J. A. Kelso, provincial analyst, Edmonton, Alta.; Professor G. M. Williams, secretary, University of Saskatchewan, Saskatoon, Sask.

Dr. T. Thorvaldson of the University of Saskatchewan, Saskatoon, in charge of the committee's chemical research was also present as well as Fraser S. Keith, general secretary of *The Institute,* who stopped off on his way to the coast.

Chairman Mackenzie presented a report summarizing the progress made during the past year in the organization of the committee and in getting the physical and chemical research underway. The Research Council of Canada, the provinces, cities and interested corporations have contributed to the funds of the committee to the extent of $13,200 per annum and payments for two years are at hand. Expenditures for the first year amount to slightly more than half of the first annual contribution owing to delays in obtaining assistants of the desired qualifications in chemical research, in which direction most of the committee's efforts will be expended.

During the past year test specimens in the form of cylinders seven inches in diameter and twenty-one inches long were molded and exposed to alkali ground waters near Cassils, Alta., Grandora, Sask., and Winnipeg, Man. In these concretes there were included several different cements, different cement contents, aggregates from three localities as well as various integral waterproofing com-

Members of the Engineering Institute Committee investigating the Deterioration of Concrete in Alkali soils, at Bassano, Alberta, June 7th, 1922, the last day of a three-day meeting.

Front row from left to right: J. A. Kelso, A.M.E.I.C., Provincial Chemist, Edmonton; Sam. G. Porter, M.E.I.C., Supt. Operation and Maintenance, C.P.R., Natural Resources, Lethbridge, Alta.; Fraser S. Keith, M.E.I.C., General Secretary, E.I.C., Montreal; Alex S. Dawson, M.E.I.C., Chief Engineer, C.P.R., Department of Natural Resources, Calgary; A. McGuire, District Sales Manager, Canada Cement Co., Calgary; Prof. J. N. Finlayson, M.E.I.C., Professor of Civil Engineering, University of Manitoba, Winnipeg; Prof. Duff A. Abrams, M.E.I.C., Professor in charge Structural Materials, Research Laboratory, Lewis Institute, Chicago.

Rear row standing: Alex Fleming, Chemist, Canada Cement Co. Montreal; H. G. Angell, A.M.E.I.C., Engineer, C.P.R. Natural Resources, Brooks, Alta.; F. C. Field, City Chemist, Calgary; R. S. Stockton, M.E.I.C., Supt. Operation and Maintenance, Western Section, C.P.R., Dept. of Natural Resources, Strathmore, Alta.; A. G. Blackie, City Chemist, Winnipeg; O. W. Moore, Engineer, C.P.R. Dept. of Natural Resources, Brooks, Alta.; Dr. T. Thorvaldson, Professor of Chemistry, Univ. of Saskatchewan, Saskatoon, engaged by the committee to carry on the chemical research work; H. McI. Weir, M.E.I.C., Assistant City Engineer, Saskatoon; Professor C. J. Mackenzie, M.E.I.C., Dean of the Faculty of Engineering, University of Saskatchewan, and chairman of the committee; Dr. J. W. Shipley, Assistant Professor of Chemistry, University of Manitoba, Winnipeg; Chas. C. Elliott, A.M.E.I.C., Canal Supt., C.P.R., Dept. of Natural Resources, Brooks, Alta.; H. S. Van Scoyoc, M.E.I.C., Consulting Engineer, Canada Cement Co., Montreal; A. W. Haddow, A.M.E.I.C., Commissioner of Public Works, Edmonton; Ernest Ashton, Chemical Engineer, Lehigh Portland Cement Co.; W. P. Brereton, M.E.I.C., City Engineer, Winnipeg; and Geo. W. Craig, M.E.I.C., City Engineer, Calgary. G. M. Williams, A.M.E.I.C., secretary of the committee, was busy with the camera at the time.

Photo by courtesy, A. Griffin, supt. maintenance and operation C.P.R., Department of Natural Resources, Brooks, Alta.

pounds and surface coatings. This programme of field tests is to a certain extent a repetition of similar work carried on in previous investigations and is intended mainly to serve as a basis of comparison with such test specimens as will later be made as the result of the chemical research. Difficulty has been encountered in obtaining the services of a properly qualified petrographer in connection with the chemical research, but now that this position has been filled progress will be made in all phases of the work.

Professor G. M. WILLIAMS, A.M.E.I.C.
Professor of Civil Engineering, University of Saskatchewan, Secretary of Committee on Deterioration of Concrete in Alkali Soils.

Monday night the party travelled to Brooks, Alta., for a two day trip over the Eastern Irrigation Block of the Canadian Pacific Railway, where the structures of greatest interest were pointed out and explained by Mr. Dawson, who as chief engineer of the Natural Resources Department had charge of the design and construction of the work. The trip was made doubly enjoyable through the courtesy of the Department of Natural Resources in furnishing a sleeping car which remained with the party throughout its stay.

Tuesday was spent in viewing the headgates of the Bantry canal at Lake Newell and Brooks aqueduct a concrete structure two miles long which carries irrigation water across a broad valley. Inspection was also made of the concrete test specimens installed near Cassils during the previous fall. While signs of deterioration were apparent on some of the specimens, those specimens placed nearby by the Calgary Branch of *The Institute* were of greatest interest. Some of these latter specimens have been in the ground for a period of over three years and alkali action has progressed to such an extent that definite conclusions can be drawn. These tests are reported in detail by Mr. Dawson in the September, 1921 issue of *The Journal.*

Wednesday was spent in the vicinity of Bassano in inspecting the Bassano dam, a large concrete structure of the Ambrusen type and various concrete drops and headgates in that locality.

This trip was not only of interest but of the greatest value to the members of the committee in connection with their present investigations, illustrating the use of concrete in large structures in varying soil and water conditions, and emphasizing the practical considerations which influence and govern the use of concrete on works of large magnitude.

The Professional Engineers' Act of Ontario

In another part of this issue of *The Journal* appears the text of the professional engineering Act of the Province of Ontario, which was passed by the Provincial House on June 5th. This Act represents the result of many months of persistent work on the part of the engineers of Ontario under whose sponsorship it was submitted to the Legislature for consideration.

Ontario professional engineers, while appreciating the work of the Advisory Conference Committee, will regret that their splendid efforts where not attended by greater success and, while the present Act gives a slight measure of protection to the profession and public, the general feeling is that the future may see amendments that will more nearly approach the Committee's original plan.

One of the principal clauses, number thirty-four, of the original Bill, which would have brought this legislation in line with the similar Acts in the provinces of British Columbia, Manitoba, New Brunswick, Nova Scotia and Quebec, was altered before it was finally passed. This clause originally read as follows:—

"Any person in the Province of Ontario who, not being registered as a member of the Association in the Province of Ontario, or licensed by the Association;

- (a) *Practises as a professional engineer;*
- (b) *Usurps the function of a professional engineer;*
- (c) Uses verbally or otherwise the title of professional engineer, or makes use of any addition to or abbreviation of such title, or of any words, name or designation that will lead to the beliet that he is a professional engineer or a member of the association, *or that he is a person specially qualified to practise in any branch of professional engineering;*
- (d) Advertises himself as a professional engineer in any way or by any means.
- (e) *Acts in such manner as to lead to the belief that he is authorized to fill the office of or to act as a professional engineer;*

shall be liable upon summary conviction by any court of competent jurisdiction to a fine of not less than \$100 nor more than \$200 for the first offence, and to a fine not less than \$200 nor more than \$500 for any subsequent offence."

The words which were deleted in this clause are shown in italics, while it will be noted, by comparison with the Act, that subsection *d* of the original was changed to read "Advertises or holds himself out in any way or by any means as a member of the Association."

From this change it will readily be seen that the greater measure of protection aimed at in the original Bill, by its sponsors, has been reduced and that the Act, which has just been passed, provides for the formation of an Association of Professional Engineers to which membership is voluntary, but at the same time restricts the use of the title "Professional Engineer" or any abbreviation thereof, or any similar designation to those who are members of the "Association of Professional Engineers of the Province of Ontario."

Recent Honours and Degrees

The congratulations of *The Institute* are extended to the following members who have recently graduated from the University of Toronto.

Honour Graduates with Degree of B.A.Sc.

Students in The Institute: George Arthur Day, B.A.Sc., (Chem. Eng.), Guelph, Ont.
James William Simpson Gibbs, B.A.Sc., B.A.Sc., (Civ.), Toronto, Ont.
Harold Glendon Hayman, B.A.Sc., (Civ.), Toronto, Ont.
John Archibald C. Kay, B.A.Sc., (Chem. Eng.), Stratford, Ont.
Ronald James McGrath, B.A.Sc., (Civ.), Toronto, Ont.
Herbert Hugo Mueller, B.A.Sc., (Chem. Eng.), Toronto, Ont.
William Ray Richardson, B.A.Sc., (Chem. Eng.), Essex, Ont.
Màlcolm Dunlop Ross, B.A.Sc., (El.), Chatham, Ont.
Simcoe Crawford Scadding, B.A.Sc., (El.), Humber Bay, Ont.
Henry Maurice Shockley, B.A.Sc., (El.), Prince Rupert, B.C.
John Harvey Westren, B.A.Sc., (Chem. Eng.), Toronto, Ont.
Lewis Alfred Guy Winter, B.A.Sc., (Chem. Eng.), Toronto, Ont.

Graduates with Degree of B.A.Sc.

Juniors in The Institute: Thomas Stanley Glover, B.A.Sc., (Civ.), Southfield, Hessle E. Yorks, England.
Bruce Henry Johnston, B.A.Sc., (El.), Toronto, Ont.
Students in The Institute: Alexander MacGregor Anderson, B.A.Sc., (Civ.), Toronto, Ont.
Wilfred R. Benson, B.A.Sc., (El.), Toronto, Ont.
Carl Louis Breithaupt, B.A.Sc., (Chem.), Kitchener, Ont.
George Fraser Bryant, B.A.Sc., (El), Midland, Ont.
David Burns, B.A.Sc., (El), Fullerton, California, U.S.A.
William Alexander Campbell, B.A.Sc., (Chem.), Toronto, Ont.
Clarence Hale Carslake, B.A.Sc., (Chem.), Toronto, Ont.
Howard McDougall Chantler, B.A.Sc., (Chem.), Toronto, Ont.
Wilfred Laurier Clairmont, B.A.Sc., (Civ.), Gravenhurst, Ont.
Terence Clarke, B.A.Sc., (El), Toronto, Ont.
Robert Harold Burton Cook, B.A.Sc., (Civ.), Aurora, Ont.
Stanley Lytton Coulter, B.A.Sc., (El.), Windsor, Ont.
James Jackson Crawford, B.A.Sc., (Chem.), Toronto, Ont.
Prosper Gerald Dunbar, B.A.Sc., (Me.), St. Thomas, Ont.
George Balderstone Fuller, B.A.Sc., (El.), Arkona, Ont.
Wilfred John Grant, B.A.Sc., (Chem.), Toronto, Ont.
Herbert Patrick Graves, B.A.Sc., (El.), London, Ont.
Alfred George Guscott, B.A.Sc., (Civ.), Toronto, Ont.
George Hammond Harlow, B.A.Sc., (Mech. Engr.), Toronto, Ont.
Albert Harold Heatley, B.A.Sc., (Chem.), Brampton, Ont.
Harold Edwin Howden, B.A.Sc., (El.), Caledonia, Ont.
Howard Hillen Kerr, B.A.Sc., (Mech. Eng.), Seaforth, Ont.
John Alexander Langford, B.A.Sc., (El), Calgary, Alta.
Michael Milinocket Montemurro, B.A.Sc., (El.), North Bay, Ont.
Harold Anthony Oaks, B.A.Sc., (Mi.), Preston, Ont.
Francis Jones Pollock, B.A.Sc., (Civ.), Almonte, Ont.
David Wellesley Rosebrugh, B.A.Sc., (El.), Toronto, Ont.
Frank Stephens Spence, B.A.Sc., (Chem. Eng.), Toronto, Ont.
John Greer Spotton, B.A.Sc., (El.), Guelph, Ont.
Malcolm Davidson Stewart, B.A.Sc., (Civ.), Montreal, Que.
Howard Grant Thompson, B.A.Sc., (Mech.), Belmont, Ont.
Frank Lloyd Wass, B.A.Sc., (Chem.), St. Marys, Ont.
Harold Stanley Weldon, B.A.Sc., (El.), Oakwood, Ont.
Stephen Williams, B.A.Sc., (Mech.), Toronto, Ont.

Degree of M.A.Sc.

A.M.E.I.C.: William Kirk Thompson, M.A.Sc., (Met.), Toronto, Ont.
Jr.E.I.C.: Chester Arthur Hughes, M.A.Sc., (Civ.), Mimico Beach, Ont.
S.E.I.C.: Morland Powers Whelen, M.A.Sc., (El.), Toronto, Ont.

* * *

Creosoted Fence-Posts Outlast Cedar

For many years it has been thought that the only timber that would give a reasonable period of service as fence-posts was cedar. The Forest Products Laboratories of the Department of the Interior, Canada, state, however, that by employing a comparatively simple method it is possible to treat posts of certain hardwoods in such a way that they will have a life at least twice as long as cedar posts. The preservative effect of this treatment is clearly shown in fencing erected at the Dominion Forestry Branch forest nursery at Indian Head in 1917. Here posts of Russian poplar were used, both treated and untreated, and it is interesting to note that all the untreated posts erected at this time have decayed and been removed while the treated posts are all still in service and appear as sound as the day they were placed in position.

OBITUARIES

Charles Garden, M.E.I.C.

Sincere regret is expressed at the death of Charles Garden, M.E.I.C., which occurred in Woodstock on May 21st, 1922. Mr. Garden was born at Upper Woodstock some seventy years ago and was educated there at a school conducted by William McIntosh and at the Carleton County Grammar school under the head mastership of James McCoy. His first venture in the engineering field was during a vacation, when he filled the position of "back picket" on the first survey of the Woodstock branch of the St. Andrews and Quebec railway, made by James R. Hartley, C.E. From this time he did surveying work off and on assisting his father. His father died when he was nineteen years of age and although still a boy, Charles Garden was appointed a provincial land surveyor. In 1879 he was engaged with his brother, Edward Garden, C.E., on government work east of Rat Portage. Perhaps his most important work was in connection with the building of the C.P.R. through the Rockies. He was one of the advance guard of the exploration party. The route of this party was via the N.P.R., to Bismark, Dakota, up the Missouri to Benton and thence by trek to Calgary and up the Bow. Only one party came over the Rockies summit. This party was in charge of Mr. McMillan with Mr. Garden as transitman and consisted of fifteen men. They came through the Vermillion, south of the Kickinghorse and made their way to what is now called "Golden". They built "The Cache" which has ever since remained, with, of course, extensive restorations and is now known as "Moodie's House."

In 1884-85 Mr. Garden worked on C.P.R., construction near lake Superior on White river, Peninsula Harbour, and it was at this time that the first through C.P.R. train went to Vancouver. He was later engaged on construction on the Deloraine branch to the coal mines for the C.P.R. He had charge of location and construction on Souris branch and was for some years in office work in Winnipeg. In 1897 he was on the location of the Crow's Nest branch, locating the loop and tunnel at Michael Creek. In 1898 he was employed by McKenzie & Mann at Rainy River and Fort Francis. For this same concern he afterwards located for the Swan river winter survey and in the summer following he located a line across Red Deer river.

In 1901 he was on the Algoma Central, Sault Ste. Marie to Michipocata Iron Mines and in construction work at Trout Lake, Chippewa and Mackie Creek. In 1903 he was in St. Paul as an expert witness in a railway case between Foley Bros. and Cook and the side for which he testified, won.

Coming nearer home, Mr. Garden was engaged on the Transcontinental survey between Grand Falls and Andover, on the Woodstock Shogomoc branch and in the Minto Chipman district. Among his many activities he was engaged on the Vancouver Electric Railway.

Within a few years past ill health caused Mr. Garden to retire from active work, and he returned to Woodstock.

Mr. Garden, who has been connected with *The Institute* for many years, was made a Life Member on March 21st last.

He is survived by his widow, formerly Miss Alice Connell, and one sister, Mrs. R. Wilmot Balloch.

Sydney Stuart Jones, Jr.E.I.C.

Regret is expressed at the news of the death of Sydney Stuart Jones, Jr.E.I.C., which occurred at his home in Dorval, Que., on May 19th, 1922, after a long illness resulting from an attack of pneumonia last August. The lat eMr. Jones was born at the Isle of Man on January 31st, 1895, where he attended Murrays Road Public School for six years, after which he came to Canada and received his high school and technical education in Montreal.

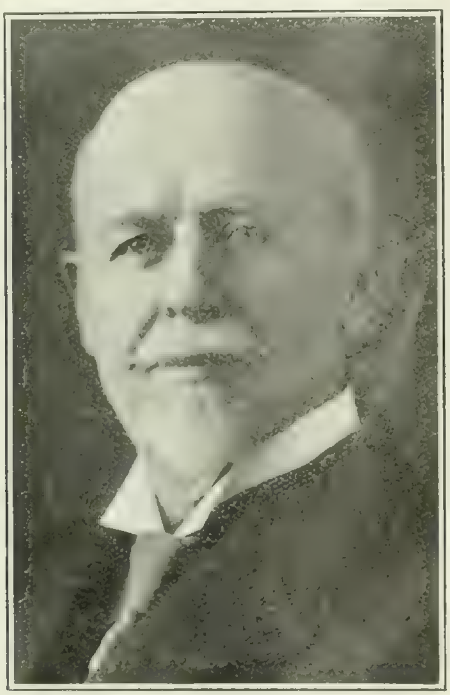
Mr. Jones commenced his engineering work in August 1912, on the construction and location surveys of the Canadian Pacific Railway. In the following year he was employed as assistant instrumentman and draughtsman under M. D. Barclay, D.L.S., on land surveys in Montreal. From 1913 to March 1915 his work was in connection with railway surveys in Ontario, New Brunswick and Nova Scotia, while a similar line of work took him overseas with theCanadian Railway Construction Corps from March 1915 to August 1918, after which he was attached to the Royal Garrison Artillery as Lieutenant Instructor until the end of the war. On returning to Canada he again took up his work on railway surveys in New Brunswick and Nova Scotia. In March, 1920, he was appointed to the staff of the Department of Soldiers Civil Re-establishment, Engineering Branch, as draughtsman on building construction and maintenance in Montreal, which position he left in June 1920 to accept an appointment with the Riordon Company at Temiskaming, Que., in connection with the planning and construction of the new town-site.

Herbert L. Wallis, M.E.I.C.

The death of Herbert L. Wallis, M.E.I.C., at his home in Montreal on May 24th last, has taken from *The Institute* one of its earliest and most eminent members, and from the engineering profession one of the outstanding figures in the early history of the engineering development of

our Canadian railways. Mr. Wallis was intimately known to all the older members of *The Institute* and to a great many of the younger members. He was one of the signatories of the Charter of the Canadian Society of Civil Engineers, and as such, his name is known to the entire membership as one of the founders of *The Institute*, one of the few men who in the early eighties, looking into the future, laid so lasting a foundation upon which to build a society to serve the profession.

The late Mr. Wallis was born at Derby, England, in 1844 and was educated at the Moravain School, Ockbrook, near Sowerby Bridge. Upon the completion of his schooling, he was apprenticed to the late Matthew Kirtley, locomotive superintendent of the Midland Railway, under whose mentorship he remained for five years.



HERBERT L. WALLIS, M.E.I.C.

In 1866 he was appointed foreman in charge of the locomotive department of the Midland railway at Bradford, the district connected with the same being also under his control. He remained in the employ of the Midland Railway Company until May 4th, 1871, when he sailed for Canada to assume the position of assistant mechanical superintendent of the Grand Trunk Railway with headquarters in Montreal. About two years after he was appointed chief mechanical superintendent, which position he held until he retired in 1896.

To enumerate the many improvements brought about under Mr. Wallis' supervision, during his quarter of a century service with the Grand Trunk Railway Company, would not be possible in the present instance, but mention must be made of the fact that the first compound locomotive upon the Grand Trunk Railway was built by Mr. Wallis and that he was instrumental in improving the shops of the company to such an extent that they were able to construct practically all the new locomotives for service during the last twenty years of his tenure of office.

In the commercial life of Canada, as well as in the engineering profession, Mr. Wallis was held in very high esteem. Among his many official positions are those of Vice-President of the Ottawa River Navigation Company, and President of the Carillon and Grenville Railway Company. Mr. Wallis was a member of the Institution of Mechanical Engineers of England and also of the Institution of Civil Engineers of Great Britain.

Mr. Wallis' membership in *The Engineering Institute of Canada* dates from January 20th, 1887, five months before the Charter of the Canadian Society of Civil Engineers was granted. During that year he was a member of the Council of the Society, while for the six succeeding years he was treasurer. In 1894, he was elected vice-president, which office he held until chosen as president for the year 1896. The following year Mr. Wallis presented a paper before the Society on "Fuel for Locomotives", which was published in the transactions of that year. Thus for the first nine years in the history of *The Institute*, (then the Canadian Society of Civil Engineers), is to be found the name of the late Mr. Wallis among the officers of the Society, during which time he devoted his best efforts in the building of *The Institute* of to-day.

Mr. Wallis is survived by his wife, formerly Miss Ida Boulter, and two sons, Haden Wallis, who is attending Ashbury College, Ottawa, and Master William Herbert Wallis of Montreal, and two daughters, the Misses Elsie and Marjorie Wallis.

* * *

Velocity Stage Turbines

Velocity Stage Turbines. A line of velocity stage turbines especially designed for high pressure and high temperature steam is described in a 28-page catalogue issued by the De Laval Steam Turbine Co., of Trenton, N.J. The cast steel steam chest is located in the casing cover in order to avoid the conduction of heat to the bearings. In addition to the speed governor and governor valve, there is an independent valve controlled by an automatic overspeed trip. The turbines are built in sizes up to 1200 hp., and are designed to be directly coupled to high speed centrifugal pumps and blowers, small A.C., and D.C., generators, and by means of double helical speed reducing gears, to large pumps and blowers, medium size generators, belt pulleys, rope sheaves and slow and moderate speed machinery.

PERSONALS

H. G. McVean, A.M.E.I.C., is leaving Regina shortly to be in Toronto for a year.

J. R. Wood, A.M.E.I.C., formerly of Evesham, Sask., is now with the Imperial Oil Company at Regina.

K. O. Elderkin, Jr.E.I.C., has accepted a position with the St. Lawrence Paper Mills, at Three Rivers, Que.

E. E. Holmes, S.E.I.C., has accepted a position with the Wayagamack Pulp and Paper Company at Three Rivers, Que.

Cuthbert J. Oliver, S.E.I.C., Sci., '23, McGill University, is with the Manitoba Power Company, Winnipeg, Man., for the summer months.

H. Jardine, S.E.I.C., of Hespler, Ont., who was for a time assistant engineer at Timmins, Ont., has been appointed assistant city engineer of Galt, Ont.

R. A. de-Valter, A.M.E.I.C., assistant engineer' Department of Public Works of Canada at Sherbrooke, has been transferred to the district of Quebec.

H. M. Morrow, A.M.E.I.C., formerly with the Dominion Iron and Steel Company has become associated with the firm of N. B. Stark and Company, Montreal.

R. B. Jennings, A.M.E.I.C., division engineer with the Canadian National Railways has been transferred from Ottawa to the Tunnel Terminal Station, Montreal.

E. A. Earl, A.M.E.I.C., who was for some time at the Gold Coast in West Africa is at present in England, residing at "Dumbarton", 192, Brixton Hill, London, S.W.

F. H. Kitto, M.E.I.C., who has been in Winnipeg for some time on business for the Natural Resources Intelligence Branch of the Interior Department, has returned.

C. E. Malone, Jr.E.I.C., who received his B.Sc., degree in Civil Engineering from Queen's University this spring is located with D. A. R. McCannel, city engineer of Regina.

Gabriel Henry, A.M.E.I.C., has been appointed consulting engineer to the Roads Department of the Province of Quebec, of which department, he was formerly chief engineer.

H. G. Thompson, S.E.I.C., who graduated in Applied Science from the University of Toronto this year, has been appointed to the staff of the American Blower Company, at Detroit, Mich.

Robert Hobson, M.E.I.C., president of the Steel Company of Canada, was elected vice-president of the Canada Steamship Lines at the annual meeting held in Montreal during May.

W. L. Dethloff, M.E.I.C., formerly chief engineer with the Mond Nickel Company, Ltd., at Coniston, Ont., is now located at Clearfield, Pa., U.S.A., with the American Nickel Corporation.

A. F. Macallum, M.E.I.C., commissioner of works, for the city of Ottawa, attended the Good Roads Convention at Victoria, B.C., representing the city and the Ottawa Branch of the E.I.C.

The Saskatchewan Branch was represented at the British Columbia Professional Meeting by H. R. Mackenzie, A.M.E.I.C., H. S. Carpenter, M.E.I.C., Regina, and A. M. McGillivray A.M.E.I.C., Saskatoon.

D. J. Emrey, Jr.E.I.C., who graduated this year from the Queen's University, has joined the staff of the Canadian Des Moines Steel Company, Ltd., in their Bridge Department at Chatham, Ont.

Major C. R. Crysdale, M.E.I.C., of Vancouver, left last September for British West Africa. His mailing address is now c/o Stewart and McDonald, Gold Coast Harbours, Seccondee, British West Africa.

H. R. McClelland, M.E.I.C., vice-president and general manager of N. E. McClelland and Company, is at present in the Old Country at the London office of the company at 53, Victoria Street, London, S.W.1.

Andrew J. Riddell, A.M.E.I.C., who was formerly with Gilbert J. P. Jacques, architect, Windsor, Ont., has now opened an office, under his own name, as architect and engineer at 355, Sandwich Street, Sandwich, Ont.

R. L. Weldon, A.M.E.I.C., for some time on the staff of the Three Rivers Pulp and Paper Company, Ltd., is now mechanical engineer at Three Rivers, Que., with this company, which is now operating under the name of the St. Lawrence Paper Mills, Ltd.

A. M. Alberga, Jr.E.I.C., formerly assistant engineer on forest exploration for the Wayagamack Pulp and Paper Company of Three Rivers, Que., is now with the engineering service of the Dominion Parks Branch, Department of the Interior, Ottawa, Ont.

S. B. Wass, A.M.E.I.C., construction engineer with the Canadian National Railways, has been transferred from Moncton, N.B., to Toronto, Ont. While at Moncton Mr. Wass had charge of the construction of the new railway yard and engine facilities at that point.

H. R. Lynn, A.M.E.I.C., formerly general manager of the Canada Slate Corporation is now a partner in the firm of Lynn MacLeod Engineering Company, Thetford Mines, P.Q., the many activities of the firm being expressed in the phrase, "Mining and Engineering Requirements".

Lucius E. Allen, M.E.I.C., formerly consulting engineer at Belleville, Ont., has opened offices in the First National Bank Building in Detroit, Mich., where he is continuing consulting engineering work and specializing in highway engineering in the United States and Canada.

F. O. White, M.E.I.C., who was previously located at Orono, Maine, has accepted the position of chief engineer of the St. Lawrence Paper Mills, Ltd., formerly the Three Rivers Pulp and Paper Company Ltd., and is in charge of the construction of the new mill at Three Rivers, Que.

James Ewing, M.E.I.C., of Montreal, has formed a new partnership with Altheod Tremblay, A.M.E.I.C., with offices in the Birks Building, the former firm of Ewing, Lovelace and Tremblay having been dissolved. Mr. Ewing intends to carry on his specialized work in town planning.

C. W. Dill, M.E.I.C., vice-chairman of the Saskatchewan Branch has resigned his position with the Provincial Government. He was chief engineer and superintendent of highways in the Department of Highways. Mr. Dill has been on the verge of a nervous breakdown and is at present in Vancouver for his health.

Col. Wm. G. Attwood, Member Am. S.C.E., director of the Committee on Piling Investigation with the National Research Council of the United States, was in Ottawa recently in consultation with the chief engineer of the Public Works Department, with a view to arranging effective co-operation in the study of destructive marine borers on the Atlantic and Pacific coasts.

Major L. E. Silcox, D.S.O., M.E.I.C., formerly locating engineer for the western lines of the Canadian National Railways, Winnipeg, Man., has gone to Gold Coast Harbours, Seccondee, Gold Coast, British West Africa. Major Silcox is the second of *The Institute's* members who has recently been reported as moving to this part of British West Africa and news from these distant members would be welcomed by *The Journal* readers.

George D. Macdougall, M.E.I.C. chief engineer of the British Empire Steel Corporation, was elected president of the Nova Scotia Mining Society at a meeting held at Sydney N.S., on May 30th. Among the other officers, who were elected are the following members of *The Institute*, C.M. Odell, M.E.I.C., T. J. Brown, M.E.I.C., R. E. Chambers, M.E.I.C., F. W. Gray, A.M.E.I.C., D. H. McDougall, M.E.I.C., and J. J. McDougall, A.M.E.I.C.

E. S. M. Lovelace, M.E.I.C., formerly of the firm of Ewing, Lovelace and Tremblay, has entered into partnership with Altheod Tremblay, A.M.E.I.C., and will carry on the practice of civil engineering and land surveying with offices in the Birks Building, 14, Phillips Square, Montreal. Mr. Tremblay, whose residence is in Quebec, is a professor at Laval University, a Dominion Land Surveyor and a member of the Board of the Quebec Land Surveyors.

G. Gordon Gale, M.E.I.C., and Fred D. Burpee, Associate E.I.C., the street railway magnates of Hull and Ottawa, respectively, attended the annual convention of the Electric Railway Association at Quebec. Honours are coming fast for Mr. Burpee. Just recovering from piloting the Ottawa Rotary Club through a strenuous year, he is elected to the board of directors of the Ottawa Electric Railway. He has now been elected president of the Electric Railway Association, at its recent convention at Quebec.

Ralph W. Downie, S.E.I.C., has been elected secretary-treasurer of the Niagara Peninsula Branch succeeding Rex P. Johnson, A.M.E.I.C., whose resignation was the result of his appointment to a new position in Chicago. Mr. Downie graduated from the University of Toronto last year and has been engaged in various engineering works for the last nine years, included in which are four and a half years overseas with the Canadian Engineers. He is at present engaged in connection with the Welland Ship canal as tester of building materials.

R. L. Dobbin, M.E.I.C., member of Council and vice-chairman of the Peterborough Branch of *The Institute*, has been elected chairman of the Canadian Section of the American Water Works Association. Mr. Dobbin has been actively engaged on water-supply engineering almost continuously since he graduated from the University of Toronto in 1910, first as resident engineer for the Walter J. Francis Company on the construction of the new system for the city of Moose Jaw, Sask., and later in 1914, as superintendent of waterworks for the Peterborought Utilities Commission, which position he still holds.

Rex P. Johnson, A.M.E.I.C., secretary-treasurer of the Niagara Peninsula Branch since 1919 and office engineer of the Hydro-Electric Power Commission, has joined the staff of the Forest Products Engineering Company of Chicago where his duties will be principally efficiency work in woodworking plants. Before taking up his new duties Mr. Johnson expects to visit the Atlantic coast for a month's holiday. With Mr. Johnson's removal, the Niagara Peninsula Branch loses a very active and energetic worker, and the congratulations and good wishes of the Branch, and *The Institute* as a whole, are extended to him in his new appointment.

C. R. McCort, A.M.E.I.C., has been appointed superintendent of construction for the Thompson-Starrett Company, Limited, in connection with the new mill being built at Three Rivers, Quebec, for the St. Lawrence Paper Mills, Limited. Mr. McCort graduated from the University of Toronto in 1915 and spent nine months of that year on research work, investigating the strength of structural timbers at the Forest Products Laboratories of Canada, at McGill University. On returning from overseas at the end of the war Mr. McCort was appointed field engineer on construction for the Laurentide Company, Limited, at Grand Mere, on which work he was superintendent of construction prior to his recent appointment.

EMPLOYMENT BUREAU

AND

MEMBERS' EXCHANGE

To make this department more valuable it is proposed that in future advertisements of situations vacant should state salary, and give details of requirements.

Situations Wanted

Civil and Mechanical Engineer

Position desired by civil and mechanical engineer with some experience in electrical and mining engineering and eleven years' experience on railway work including surveys and construction as draughtsman, instrumentman and resident engineer; can speak French and German and has a knowledge of Spanish and Italian. Apply Box No. 107.

Civil and Electrical Engineer

Recent graduate in electrical engineering from Nova Scotia Technical College, age 26, three years service overseas, two summers on instrument work in connection with power development in Nova Scotia. Desires employment on any type of engineering work. Apply Box No. 105.

Civil Engineer

Recent graduate of University of Toronto, Faculty of Applied Science, at present employed as instrumentman with the Surveys Branch of the Federal Government, is desirous of obtaining a position on a municipal engineering staff. Apply Box No. 104.

Civil Engineer

Engineer, Jr.E.I.C., desires position on the engineering staff of a municipality or with contractors. Ex-

perienced in design and construction of sewers, supervising construction of reinforced concrete work, pavements, surveys. Excellent draughtsman, expert on quantities. Salary $160.00 to $180.00 per month. Apply Box. No.106.

Situations Vacant

Engineer with knowledge of Portugese

Contracting company requires the services of a competent engineer having a knowledge of the Portugese language. Apply Box 216.

Mining Inspector

A mining Inspector for the Provinces of Alberta and Saskatchewan, Department of the Interior, with headquarters at Calgary, Alta., at an initial salary of $2,100 per annum, which will be increased upon recommendation for efficient service at the rate of $120 per annum until a maximum of $2,580 has been reached. This initial salary will be supplemented by whatever bonus may be provided by the law.

Duties.—To inspect mining operations under the direction of the Mining Engineer in order to determine the amount of royalties to be paid the Government; to consult with mine managers with a view of securing a maximum recovery of coal and of determining whether proper conservation measures are in use; to make underground and surface surveys of coal mines; to compute the quantity of coal mined at regular intervals; to make special investigations and reports regarding the development of natural resources; to see that the mining regulations are strictly complied with and to perform other related work as assigned.

Qualifications.—Education equivalent to high school graduation, either graduation in engineering from a recognized school of applied science with three years' experience in the practical development and operation of coal mines, or, the holder of a first class certificate of competency with five years' additional experience in the practical development and operation of coal mines; thorough familiarity with Departmental Mining regulations; knowledge of the theory and practice of coal mining and of the Dominion Land System of Surveys; ability to make investigations and prepare reports; good judgment, firmness and tact. While a definite age limit has not been fixed, age may be a determining factor when making a selection.

Application forms properly filled in must be filed in the office of the Civil Service Commission not later than July 13. Application forms may be obtained from the offices of the Employment Service of Canada, from the Postmasters at Prince Rupert, Vancouver, Victoria, Edmonton, Calgary, Regina, Winnipeg, Quebec, Charlottetown, Halifax, Fredericton, and St. John, or from the Secretary of the Civil Service Commission.

By order of the Commission.

W. FORAN,
Secretary.

Members' Exchange

Back Numbers of The Journal Wanted

The Librarian of the University of Cape Town wishes to secure the May, July and August numbers of The Engineering Journal of the year 1918, (Vol. 1, Nos. 1, 3 and 4) in order to complete the set for the University library. A request has also been received for a copy of *The Journal* of October 1920 (Vol. 3, No. 10). The Secretary will be pleased to receive these from any members who may have copies to spare.

ELECTIONS AND TRANSFERS

Elections and Transfers

At the meeting of Council held on June 27th, 1922, the following elections and transfers were effected:—

Members

Bladon, James Buckley, chief engineer, Darling Brothers Limited engrs. and mfrs., Montreal, Que.
Cartmel, William Bell, M.A. (Univ. of Nebraska), transmission engr., Northern Electric Co., Ltd., Montreal, Que.
Casey, William, vice president and genr. mgr., Canadian Locomotive Company, Kingston, Ont.
Gillis, Hugh Bernard, B.Sc. (McGill Univ.), supt. in chg. of ore mines and quarries dept., Dominion Iron & Steel Co., Sydney, N.S.
Wright, James Alpheus, chief engr., Parker Motor Car Co., Ltd., Montreal, Que.

Associate Members

Bishop, Willis D., designing and estimating engr., Northern Electric Co.. Ltd., Montreal, Que.
Bone, Allan Turner, B.Sc., (McGill Univ.) of Montreal, Que.
Clarke, John Leonard, B.Sc. (London Univ.), Bell Telephone Co. of Canada, Montreal, Que.
Cole, Donald, consulting engr., Detroit, Mich., U.S.A.
Davis, William Boyd, B.A.Sc. (Univ. of Toronto), in charge of construction at Lakefield Dam.
Donald, Alexander Stuart, res. engr., N.B. Electric Power Comm., Musquash, N.B.
Fraser, John Alfred, ventilation engr., and chief inspctr. on airway constrn., Dominion Coal Co., Glace Bay, N.S.
Nelson, James Barron, struct'l. designer and checker on super-structures for power houses, H.E.P.C., of Ont.
Paterson, Graham Ferguson, designer, sewer section, works dept., City of Toronto, Ont.
Reid, Brian Lee, res. engr., in charge of operation and constrn., Peace River Extension, Central Canada Rly.
Smith, Ernest, of Edmonds, B.C., engr., for the Corpn. of the district of Burnaby.
Spark, Harry S., asst. to G. E. Vogt, consltg. engr., Baltimore, U.S.A.

Juniors

Barlow, Arthur, mining engr's. dept., Dominion Coal Co., Glace Bay, N.S.
Gates, Grant Gordon, of Hamilton, Ont.
Hobart, George Maxwell, B.Sc., (McGill Univ.), industrial and chemical engr., Somerville Paper Boxes, Limited, London, Ont.
MacKay, Clarence, dftsman., Dominion Iron & Steel Co., Sydney, N.S.
Wimberley, Arthur Cecil, engr'g. clerk, irrig. branch, Dept. of the Interior, Ottawa, Ont.

Transferred from the class of Associate Member to that of Member

Kerr, Adam Thomas, divn. engr., Board of Railway Commission for Canada, Calgary, Alta.
Rannie, John Leslie, B.A.Sc., (Univ. of Toronto), D.L.S., D.T.S., supervisor of triangulation for Geodetic Survey of Canada, Ottawa Ont.
Seibert, Frederick Victor, B.A.Sc. (Univ. of Toronto), O.L.S., D.L.S., A.L.S., S.L.S., of Ottawa, Ont.

Transferred from the class of Junior to that of Associate Member

Milot, Camille, B.A.Sc., (C.E. Laval Univ.), Dept. Public Works and Labour, Bridge Division, Quebec.
Smith, Ernest E., B.A.Sc. (Univ. of Toronto), chief asst. to R. W. Code, Windsor, Ont.

Transferred from the class of Student to that of Associate Member.

Chambers, Hugh Dalford, B.Sc. (McGill Univ.), of Montreal, mgr., Canadian Office, G. D. Peters & Co., Ltd., of London, England.
Desjardins, Olivier, B.A.Sc. (Ecole Polytechnique), civil engr., Quebec Provincial Govt. Dept., Public Works, Bridge Division, Quebec.
Downie, Ralph Waldo, B.A.Sc. (Univ. of Toronto), tester of building materials, Welland Ship Canal, Thorold, Ont.

BRANCH NEWS

Hamilton Branch

W. F. McLaren, M.E.I.C., Secretary-Treasurer.

The annual meeting of the Branch, was held at 12.15 p.m. Monday, 22nd May 1922, at the Arcade. After enjoying an excellent lunch the chairman, E. H. Darling, M.E.I.C., called upon the secretary to read his report, which read as follows:

During the year nine Branch meetings were held, besides this annual meeting, all of which were reported in the Branch news of *The Journal.* The speakers and subjects were as follows:—

Nov. 1st. H. Harriman,— "St. Lawrence Power".
" 24th. Brig.-Gen. C. H. Mitchell,— Annual dinner.
Dec. 16th, Prof. Peter Gillespie, M.E.I.C., "Sir. Sanford Fleming".
Jan. 13th, Prof. C. R. Young, M.E.I.C., "Detroit-Windsor Bridge".
" 27th, T. H. Hogg, M.E.I.C., "St. Lawrence Power".
Feb. 16th, R. J. Durley, M.E.I.C., "Standardization".
Mar. 3rd, F. H. Farmer, M.E.I.C., "Installing Electric Apparatus".
" 24th, J. F. Peters — "220,000 Volt Transmission".
May 16th, Fryer & Darling — Architects Lunch.

The average attendance at these meetings was 85. Our executive committee held nine meetings, with an average attendance of four out of nine members. The following table shows changes of membership during the year:

Class	June 1, 1921	Resigned or transferred	New Members Joined	New Members Transferred	Total May, 31st, 1922
Members	17	0	0	3	20
Assoc. Members	54	8	2	12	60
Juniors	7	1	0	4	10
Students	29	5	0	3	27
Affiliates	55	8	7	0	54
Totals	162	22	9	22	171

There are many affiliates who are engineers and it is much to be regretted that they do not see fit to become corporate members. There is an opportunity for every member to become a canvasser.

Messrs Ford and Hubbard were elected auditors. The financial statement showed:

Receipts	$402.12
Expenses	344.54
Excess receipts	57.58
Last year's balance	144.80
Balance in bank	$202.38

The scrutineers' report showed the following elected as next year's executive:—Honorary Chairman, H. U. Hart, M.E.I.C.; Chairman, F. W. Paulin, A.M.E.I.C.; Vice-Chairman, J. W. Tyrrell, M.E.I.C.; Secretary-Treasurer, W. F. McLaren, M.E.I.C.; Executive Committee, H. G. Bertram, M.E.I.C., (1 year); P. M. Smith, M.E.I.C., (1 year); J. J. Mackay, M.E.I.C., (2 years); C. H. Marrs, M.E.I.C., (2 years); Past Chairman, E. H. Darling, M.E.I.C.; Councillor, E. R. Gray, A.M.E.I.C.

The proposed amendments to by-laws failed to carry, due to lacking a two-thirds majority for either.

The retiring chairman, E. H. Darling, M.E.I.C., then reviewed the year's work referring to the joint meetings held with the Chamber of Commerce and the Architects. The city had on two occasions asked the co-operation of the engineers. In closing, he urged all engineers to become members, as an organization could obtain results where an individual was helpless. The new chairman, F. W. Paulin, A.M.E.I.C., was then called upon. In speaking of the value of *The Engineering Institute* to the profession, he pointed out that he had quite frequently been asked to name an engineer for some particular undertaking but was often unable to do so, through not knowing of an available man. *The Institute* helps us to know each other. Mr. Gray moved a vote of thanks to the retiring executive, to which the secretary responded. The meeting then adjourned.

Peterborough Branch

R. C. Flitton, A.M.E.I.C., Secretary.

Visit to Hydro-Electric Power Station at Ranney Falls, Campbellford, Ont.

On June 3rd about forty-five members and guests from the Peterborough Branch proceeded by motor to Campbellford, Ont., where an inspection was made of the Hydro-Electric Power Commission's new 10,000-h.p. development at Ranney falls. It was a unique opportunity to see the entire plant and the visitors were shown all the interesting features from the roof of the power-house to the bottom of the tail-race. This plant is the largest work which the commission has on hand at the present time, with the exception of the Queenstown-Chippawa development. All who were fortunate enough to participate in this inspection were unanimous in their expressions as to the high standard of workmanship which had been maintained throughout.

After the inspection of the plant had been made the engineers congregated at the Windsor Hotel where they were the guests of the Hydro Commission at a somptuous repast. L. G. Ireland, chief municipal engineer for the Commission, who presided at the table expressed the pleasure of the Hydro at having the party visit the plant, pointing out that they had picked an opportune time, as in a few weeks the water would likely be let in.

A vote of thanks to the Hydro was moved by P. P. Westbye, M.E.I.C., chairman of the Peterborough Branch and was seconded by R. Hicks, chairman of the Peterborough Utilities Commission. The guests were welcomed to Campbellford by Mayor A. J. Meyers, who also spoke of the excellence of the work which had been done at the Ranney Falls plant. Deputy Reeve Nelson Stone spoke along similar lines. Other speakers were A. E. Caddey, M.E.I.C., engineer of the Trent Valley canal at Campbellford; Leon Frazer, secretary of the Peterborough Chamber of Commerce; H. C. Don Carlos chief of operation of the Hydro; P. L. Allison, M.E.I.C., honorary chairman of the Peterborough Branch; F. H. Dobbin, Sr.; R. L. Dobbin, M.E.I.C., and G. B. Smith of Belleville,

superintendent of operation of the Central Ontario System of the Hydro.

During the programme the guests were entertained by Mr. Fred Woolnough of New York who gave some humourous stories. The function ended with three cheers for the Hydro and the singing of "Auld Lang Syne", and the party was soon on its way after having spent a very enjoyable and interesting time in Campbellford. The arrangements for the outing were in the capable hands of James Mackintosh, A.M.E.I.C., and E. R. Shirley, M.E.I.C., of Peterborough who were assisted by A. E. Caddy, M.E.I.C., of Campbellford, G. B. Smith of Belleville, Fred A. Burgar, A.M.E.I.C., superintendent of construction and A. L. Malcolm, A.M.E.I.C.

Peterborough Branch visits Campbellford, Ont., and inspects Hydro-Electric Power Commissions' Ranney Falls Development

1. W. G. Cornell	13. W. H. Bradburn	25. B. Ottewell	37. J. E. Ross
2. T. E. Gilchrist	14. E. F. Mason	26. H. O. Fisk	38. F. H. Dobbin
3. H. A. Fife	15. P. H. Smedmore	27. J. Dibblee	39. A. L. Malcolm
4. R. C. Flitton	16. O. R. Thompson	28. L. G. Ireland	40. F. Marshall
5. E. R. Shirley	17. O. H. Scott	29. J. Mackintosh	41. H. R. Sills
6. R. L. Dobbin	18. J. Anderson	30. A. H. Munro	42. F. A. Burgar
7. W. M. Cruthers	19. P. C. Denyes	31. F. J. Woolnough	43. Leon Frazer
8. B. L. Barns	20. G. C. Gladman	32. F. J. Igoe	44. A. L. Dickieson
9. P. P. Wetsbye	21. T. A. Lang	33. A. Roberts	45. A. B. Gates
10. R. Hicks	22. R. H. Parsons	34. L. A. Potvin	46. G. R. Langley
11. P. L. Allison	23. G. S. Parlour	35. L. B. Kingston	47. A. E. Caddy.
12. A. A. Richardson	24. W. H. Gregory	36. G. E. MacFarlane	

Border Cities Branch

J. Clark Keith, A.M.E.I.C., Secretary-Treasurer.

The regular May meeting of the Border Cities Branch was held in the Windsor Collegiate on May 19th when Colonel Boyden of the Portland Cement Association addressed an open meeting.

There was a small attendance due to counter attractions for many members on that evening. Those present heard a very instructive address and it was unfortunate that many more were not present. The lecture was illustrated by slides and those who desired a copy of the subject matter of the address received it upon request.

The common conception of concrete is that we can take cement sand, stone and water and put concrete making ability into them. The development of concrete until recent years was very much without laboratory research due to lack of funds and such research dealt with reinforced concrete more than with actual mixtures. One billion dollars worth of concrete in United States last year might have affected a saving of 25 per cent if fundamental laws had been understood. Because of this lack of knowledge, a laboratory was established in 1914 at the Lewis Institute by the Portland Cement Association, representing 95 per cent of the cement manufacturers of America. In this laboratory, 75,000 tests are made annually. The first report was made by Professor Duff Abrams after five years work, the facts established being proven by thousands of tests. These tests covered: (1) Study of characteristics of ingredients; (2) Study of combination of ingredients; (3) Study of manipulation of concrete.

There are just three ingredients to be considered — cement, aggregate and water. All cement is made to a minimum specification and must pass the standards of the American Society of Testing Materials in order that the manufacturer may be admitted to membership in the Portland Cement Association. Sand must be clean, hard and not too fine. Rounded particles find their way more readily into open spaces than sharp particles and require less water to produce a given result. It must be clean — 1/1000 part of organic impurity reduces the strength of the mixture 25 per cent and impurities are hard to wash out. Fine sands produce the same results as coarse sands. In coarse aggregates, the hardness is secondary in abrasion. Light aggregates give high abrasive qualities dependent upon the relative quantity of the mixing water. Water content is equally as important as cement. The physical qualities of water, excepting alkaline or saline elements have little effect upon concrete unless humus is contained. The temperature of the water between freezing and boiling has no effect on concrete. The water cement ratio is the most important factor in concrete, the proportioning by arbitrary volume is wrong, the lower the water-cement ratio, the stronger the mixture.

The strength of concrete is found to have a direct relation to the "fineness modulus" which is a function of the sieve analysis of the aggregate used for any particular concrete. As a practical application of the "fineness modulus" in order to be assured of quality in concrete, specifications are now drafted in which the finished product must have a definite compressive strength in twenty-eight days.

The slump test, mixing, and protection of concrete were covered in much detail and two conclusions were deduced as a result of laboratory research. (1) Each mixture should be designed to produce a concrete of a certain desired strength with the ingredients available. (2) The important features in the making of good concrete should be emphasized.

There was much useful discussion at the close of Colonel Boyden's address, almost everyone in the hall being interested in some particular phase of concrete construction.

Ottawa Branch

F. C. C. Lynch, Associate E.I.C., Secretary-Treasurer.

Accuracy in the mixing of cement is absolutely essential, if satisfactory results are to be obtained, according to Col. H. L. Boyden, special engineer of the Portland Cement Association. Col. Boyden was speaking before the Ottawa Branch, at the University Club, and gave to the large number of engineers present much valuable information on the modern uses of cement and the results of experiments under varying conditions. He strongly advised engineers to carefully study the various requirements of specifications and, instead of specifying proportions of ingredients, to require results from contractors and builders. In this way much less trouble would be encountered and more satisfactory work would be produced. Col. Boyden said that far too much importance is attached to the quality of stone used, stating that often, owing to precedent, a certain kind of stone is specified, which has to be brought to the work at heavy cost, while a local stone is often available. Correct proportions of cement and water are the chief requirements.

The Hudson Bay Railway

Engineers will be interested in the discussion on the Hudson Bay railway which took place in the House of Commons on Saturday, June 10th. In reply to enquiries Hon. Mr. Kennedy, Minister of Railways, replied that the government would shortly make an announcement regarding the Board of Directors of the Canadian National Railways, and that the question of the completion of the Hudson Bay railway would be referred to the new board. It was stated that the road up to the present had cost about $20,000,000, and that it would take about $5,000,000 more to complete the railway and $10,000,000 for the terminals.

Interest in proposed Graduate School.

Ottawa engineers are greatly interested in the proposals for a graduate school advanced by Dr. F. D. Adams, Hon. M.E.I.C., at the inter-university congress recently held in Winnipeg. There is great need for a more effective co-operation between Canadian universities in furnishing facilities for graduate work. Especially is this so in engineering and cognate science. The suggestion of Dr. R. W. Brock, Dean of the Engineering Faculty at the University of British Columbia, that Canadian univer-

sities immediately pool their facilities to establish a graduate school at Ottawa, the capital of the Dominion, offers a very happy and satisfactory solution to the general problem.

Moncton Branch

M. J. Murphy, A.M.E.I.C., Secretary-Treasurer.

The report of the Executive committee, as presented at the annual meeting of the Branch, was published in last month's news and in it were outlined the activities during the past year. At the same meeting the retiring chairman, J. D. McBeath, M.E.I.C., reviewed the progress of the Branch as follows:

Retiring President's Address

Gentlemen:

As this is the last meeting at which it will be my pleasure to act as your chairman, a short review of our activities during the year 1921-22, with a few impressions and suggestions, will probably not be misplaced.

The Branch started the year with a total membership of 44 which has since increased to 66, a gain of 50 per cent.

We might be pardoned in saying that we are proud of this showing, especially when several of the other Branches have not shown a very large percentage of increase.

Meetings at Sackville

I am of the opinion that the holding of two meetings at Sackville with the Engineering Society of Mount Allison University has resulted in a benefit to all concerned, and its continuation is recommended to the executive for next year.

Papers

Some very excellent papers were submitted during the past year, a detailed statement of which appears in the report of the secretary. I consider we are indebted to the chairman of the Papers committee for his energy and hard work during the time this office was entrusted to him. I would suggest that the papers in the future be made as interesting and practical as possible, giving more attention to local engineering questions and constructive work. It would appear that papers of this nature would be more satisfactory than more theoretical ones.

Policy

Your chairman is strongly of the opinion that this Branch should take a decided step and make definite recommendations to the parties concerned in local public engineering questions. For example, I believe they should submit to the public well defined recommendations on the hydro-electric question, both from a development and distribution standpoint; recommendations should be made on the conservation of natural gas; on the elimination of wooden poles from our main thoroughfares; on the elimination of grade crossings; on the establishment of parks and playgrounds, and on street illumination, etc. These are questions which affect us not only as citizens but as engineers, and our fellow citizens should have the benefit of the training of the engineer to help them solve these public questions. Special committees from our organization might be appointed to consider each one of these subjects. It is only in this way that the full worth of the engineer will be realized and the profession occupy the place which it deserves.

Meetings

The policy adopted of having one of our monthly meetings take the form of a supper meeting is a good one and I think should be continued. It may be said without contradiction that we have without exception enjoyed our meetings during the year. Not only have we been benefited from an engineering standpoint, but we have learned to know one another better and have come to recognize the peculiar problems with which each one is confronted.

Co-Operation

In conclusion I wish to thank the secretary and all other officers and members for their very hearty co-operation during the year, and if each one realizes that our organization is just what we ourselves make it and does everything in his power to promote its interests, I am sure that the Moncton Branch of *The Engineering Institute of Canada* will not only be an invaluable organization in the community but will be one of the best Branches in Canada. I trust that you will give to the officers for 1922-23 the same support as you have given to the officers for 1921-22.

J. D. McBeath,
Chairman, Moncton Branch, E.I.C.

Election of Officers

The scrutineers, A. E. Oulton, Jr.E.I.C., and H. F. Finnemore, A.M.E.I.C., announced the following officers elected for the ensuing year,—Chairman, F. B. Tapley, M.E.I.C., engineer of maintenance, Canadian National Rlys.; Vice-Chairman, F. B. Fripp, A.M.E.I.C., harbour engineer, C.N.R.; Secretary-Treasurer, M. J. Murphy, A.M.E.I.C., asst. engineer, C.N.R.; Executive Committee,—G. C. Torrens, A.M.E.I.C., division engineer, C.N.R., C. S. G. Rogers, A.M.E.I.C., asst. engineer of bridges, C.N.R., A. S. Gunn, A.M.E.I.C., asst. engineer, C.N.R., J. G. Dryden, A.M.E.I.C., asst. engineer, C.N.R., Prof. McKiel, A.M.E.I.C., Mount Allison University, K. Gordon, A.M.E.I.C., asst. engineer, C.N.R., A. F. Stewart, M.E.I.C., chief engineer, C.N.R., (Ex-Officio), J. D. McBeath, M.E.I.C., city engineer, Moncton (Ex-Officio).

The chairman called on the newly elected officers for a few remarks, Messrs. Gunn, Rogers, and Gordon responded with a few well chosen remarks thanking the members of Moncton Branch for the confidence shown in electing them to the several offices and assured the members present that they would do everything in their power to promote the good work and welfare of *The Institute* in general and the Moncton Branch in particular, during the coming year.

A vote of thanks was tendered the retiring chairman and vice-chairman, J. D. McBeath, M.E.I.C., and S. B. Wass, A.M.E.I.C., with congratulations on the success attained during their term of office.

Vancouver Branch

P. H. Buchan, A.M.E.I.C., Secretary-Treasurer.

Paper on the Gas Industry.

On Tuesday evening, May 9th, a general meeting of the Vancouver Branch was held in the Board of Trade building for the purpose of hearing an address by John Keillor, gas engineer of the Vancouver Gas Company on the "History and Development of the Gas Industry". A large number of lantern slides were shown, which very clearly illustrated the important steps in the advancement of the manufacture of coal gas, since the first practical attempt at gas-lighting in 1797, by that indefatigable experimenter James Murdoch, who succeeded in illuminating his house and office at Old Cumnock, Ayrshire, Scotland, with gas distilled from coal in an iron retort.

The first gas mains in a public street were the lead pipes laid in Pall Mall in December 1806, and the first gas-lighting of public streets occurred on January 28th, 1807. In 1810, the first company was incorporated by the British Parliament for the manufacture and sale of gas and coke, known as the London and Westminster Gas Light and Coke Company. The gas meter was invented by Clegg in 1815, but was not adopted by this company until 1840. Broadmeadow patented the exhauster in 1824 and in 1825, Samuel Crossby invented the gas governor. The first gas lighting in the United States occurred in Baltimore in 1816, and the first in Canada was in Montreal in 1840.

Mr. Keillor dwelt at some length on the early experiments, the first being conducted by James Murdoch in an old teapot. He made many references to the popular disapproval of the invention, a good illustration of which may be joined in the following lines which were current in Glasgow during that period:

"We thankful are that sun and moon,
Were placed so very high,
That no tempestuous hand might reach,
To tear them from the sky.
Were it not so, we soon should find
That some reforming ass,
Would straight propose to snuff them out,
And light the world with "GAS".

After outlining the history of the industry, Mr. Keillor exhibited numerous slides illustrating the various steps in the improvement of retorts, purifiers, coking plants, etc. He dealt with the problems involved in the saving of by-products, which were formerly lost, and illustrated the newest departuie in England, where it is now legal to completely gasify coal, leaving practically no coke or other by-products.

The Vancouver Branch invited the Canadian Pacific Section of the Society of Chemical Industry to the meeting to hear this most interesting paper. We believe that the practice of extending such courtesies to other organizations, when opportunities arise, will enhance the usefulness of *The Institute* in a way which is both a pleasure to ourselves and a benefit to our friends.

Association of Professional Engineers' Notes.

At a Council meeting of the Association of Professional Engineers of B.C. held on Saturday night, May 13th, a suggestion was received from various members to the effect that on account of the constitution only calling for one meeting a year, many members feel that the moment the meeting is over they have no further interest in the Association for another period of twelve months. They suggested that in connection with other bodies a monthly or two-monthly luncheon would serve the double purpose, of being able to discuss Association matters or engineering works of interest, and perhaps socially to create an opportunity of meeting brother engineers. It was therefore decided that the secretary of the Association should arrange the first luncheon, which it is hoped will be held towards the end of this month, and that thereafter a committee of members will take care of this activity in order that these luncheons may become a permanent function.

Information has been received that the Board of Examiners of the Association of Professional Engineers is drawing up the syllabus for the forthcoming examinations and it is hoped that shortly the syllabus in full will be available to those desiring entrance by examination. Mr. Bertram Chase Footner of Wallachin, B.C., and William Lloyd Affleck, B.C.L.S., of Nelson, B.C., were admitted to membership in the Association by examination of the credentials.

The registrar is in receipt of a letter from C. R. Crysdale, M.E.I.C., addressed from the Gold Coast Harbours, Seccondee Gold Coast, British West Africa, of April 7th in which Mr. Crysdale acknowledges the receipt of the minutes of the general meeting of the Association and indicates his pleasure at the successful work accomplished by the Association. He states that his work up to date has been most interesting, instructive and enjoyable and he hopes in the near future to send us some information and particulars regarding the same.

Calgary Branch

J. A. Spreckley, A.M.E.I.C., Secretary.
Floyd K. Beach, A.M.E.I.C., Branch News-Editor.

On June 5th, Professor Duff A. Abrams, M.E.I.C., M. Am. Soc. C.E., Professor in charge Structural Materials Research Laboratory, Lewis Institute, Chicago, addressed the Calgary Branch, on improved methods of designing and making concrete. The public were invited to attend the meeting and a large turnout of *Institute* members and of contractors and others interested in concrete listened with great interest to the lecture. As he is giving the same talk to other branches, and is supplying his manuscript for publication in full in *The Journal*, a summary is not given here, but the discussion is of interest generally.

The question was raised as to whether any steps are being taken to draw up specifications which can be used in the place of the old 1: 2: 4 or similar ratio clauses. The inquirer felt that if ratio clauses are to be dropped, some other form of specification must be substituted. Professor Abrams was not inclined to commit himself as to the desirability of long drawn specifications. He pointed out that aggregates differ so widely in different localities that specifications drawn for one locality or job might be very undesirable elsewhere, and suggested that the farthest a general specification could go, would be to fix certain compressive strengths for finished concrete. Beyond this it was implied that the specifications must be drawn to fit local conditions and the requirements of the job, and great dependence placed on the inspection and testing of the work as it proceeded.

The committee of *The Institute* investigating the effect of alkali on concrete was in session in Calgary during the day and they were present at the lecture. As their deliberations were not complete, various questions by interested engineers, leading to the solution of alkali difficulties, were left unanswered by the speaker. Questions as to the effect of low temperatures on fresh concrete and methods of securing good concrete poured under low temperature conditions were left without much discussion, as they did not come under the immediate research of Professor Abrams.

After the discussion a number of visiting engineers were called on for brief remarks. Among the visitors who were welcomed were:—Fraser S. Keith, M.E.I.C.; C. J. Mackenzie, M.E.I.C.; G. M. Williams, A.M.E.I.C.; W. P. Brereton, M.E.I.C.; J. N. Finlayson, M.E.I.C., W. McI. Weir; R. S. Stockton, M.E.I.C.; A. W. Haddow, A.M.E.I.C.; Dr. J. W. Shipley; T. Thorvaldson; A. G. Blackie; J. A. Kelso; A. Griffin; C. M. Arnold, M.E.I.C.; S. G. Porter, M.E.I.C.; and H. B. Muckleston, M.E.I.C.

Publicity Work in Alberta.

The work of the Publicity Committee of the Alberta Association of Professional Engineers is worthy of note by engineers in other parts of the Dominion. It is easy to say that the engineer should enter more fully into the life of the community and keep the public in touch with what he is doing. It is quite a different matter to achieve this. Many engineers are engaged in work for clients who may not wish their private affairs made public. Others are in the employ of corporations government departments and are not at liberty to make their work public, except through formal reports published by their respective departments. For these and other reasons it is only by great effort that any news of current engineering work finds its way to the press direct from the engineer. It is, therefore, felt that considerable credit is due to Major Frank Emery, A.M.E.I.C., chairman of the Publicity Committee of the Alberta Association. Due to his efforts, a series of articles readable by the general public, have been appearing in the Calgary Herald. Each "story" has appeared under the name of the particular writer as *Member of Alberta Association of Professional Engineers*, and somewhere in the article, the point is made that the public is protected where a professional engineer is responsible for the kind of work described. In addition, editorials have appeared in the local press, commenting favourably on the appointment of professional engineers to certain provincial government posts.

Presentation to the Past Branch Secretary-Treasurer.

At a general meeting of the Branch, held on Friday April 28th, A. L. Ford, M.E.I.C., past secretary-treasurer, was presented with a silver wrist watch in appreciation of his services in that office. The presentation was made by P. J. Jennings, M.E.I.C., chairman, who spoke of the excellent condition of the Branch, both financially and in membership during Mr. Ford's tenure of office.

Saskatchewan Branch

D. A. R. McCannel, A.M.E.I.C., Secretary-Treasurer.

On June 14th a meeting of the Papers and Library Committee was held to prepare plans for the fall and winter meetings. It was decided to recommend that two meetings a month be held commencing in October. The selection of subjects for papers was then considered. This was facilitated by the action of the convenor, Lieut.-Col. A. C. Garner, M.E.I.C., who some weeks ago had S. R. Parker, A.M.E.I.C., submit to him a list of subjects, (thirty-six in number), which were sent out to each member of the committee with a request for written comments and suggestions. These replies were gone over first and the list was then boiled down to seventeen which were considered to be of special interest to the members. It is the intention of the committee, as soon as contributors for the proposed papers are definitely secured, to have the completed programme printed and forwarded to every member of the Branch.

Plans were also formulated for the summer meeting to be held in Moose Jaw on July 14th. J. D. Peters, A.M.E.I.C., the Moose Jaw member of our committee was present and gave assurance of hearty co-operation from the members residing in his city to make this meeting a valuable one.

Halifax

O. S. Cox, A.M.E.I.C., Secretary-Treasurer.

At a special meeting of the Halifax Branch held on May 10th, Col. H. C. Boyden delivered an address on the above subject. The meeting was called to order at 8.15 p.m. and the Chairman introduced the speaker as one eminently fitted to deal with the subject, owing to his long practical experience in the use of concrete and to his connection with the Research Department of the Portland Cement Association.

Annual Meeting of the Branch

The annual meeting of the Branch was held in the Green Lantern on May 30th, 1922, at 6.15 p.m., chairman C. E. W. Dodwell, M.E.I.C., presiding. The minutes of the previous annual meeting were read and approved. The report of the secretary-treasurer for the Branch year was then read as follows:—

Secretary-Treasurer's Report for 1921-22

Mr. Chairman and members of the Halifax Branch.—

During the year 1921-22 the Branch has held nine meetings, as follows:—

Annual Meeting of Branch, May 17th, 1921, at which the regular business was transacted and the officers for the year elected. Attendance, 27.

October 20th—Address by Prof. F. H. Sexton who gave an account of his trip overseas, with special reference to reconstruction in France. Attendance, 46.

Nov. 18th— Paper by I. P. Macnab, M.E.I.C., on "General Tramway Engineering." Attendance, 42.

Dec. 19th—Paper by H. W. Johnson on "Town Planning". Attendance, 42.

Jan. 17th—Paper on "Problems encountered in Local Building Construction" by C. St. J. Wilson, A.M.E.I.C. Attendance, 46.

Feb. 16th—Paper by K. L. Dawson, A.M.E.I.C., on "A Lump of Coal". Attendance, 30.
March 29th—Paper by W. G. Hardy, A.M.E.I.C., on "Engineering underground in France." Attendance, 35.
April 26th—Paper by H. B. Pickings, A.M.E.I.C., on "Some Problems met in surveying."
May 10th—Special meeting at which an address was given by Col. H. C. Boyden on "Recent Development in Concrete."

The membership of the Branch is as follows:—

Members	26
Assoc. Members	46
Juniors	16
Students	12
Br. Affiliates	5
Total	105

This is a loss of ten from last year's total when there were 115 members. The majority of these losses have been occasioned by the removal of members from within the jurisdiction of the Branch.

Receipts		
Rebates from Head Office and Branch News	$309.94	
Fees from Branch Affiliates	25.00	
Bank Interest	4.62	
Balance on hand May 17th, 1921	91.07	
		$430.63
Disbursements		
Clerical help	$60.00	
Stamps and Post Cards	26.66	
Journal Subs. for Br. Affiliates	6.00	
Entertainment of Guests	2.60	
Telegrams	.91	
Printing	18.35	
Expenses of Meetings	4.00	
Expressage	3.20	
Expenses Secty's meeting at Montreal	45.00	
Honorarium to Secty's	50.00	$216.72
Balance on hand		$213.91

The adoption of this report was carried on motion of F. A. Bowman and L. H. Wheaton. The report of the scrutineers was then read and the following declared elected as Branch officers for the ensuing year:—Chairman, F. R. Faulkner, M.E.I.C.; Secty-Treas., O. S.Cox, A.M.E.I.C., Exec. Committee, I. P. Macnab, M.E.I.C., C. A. Fowler, A.M.E.I.C., A. F. Dyer, A.M.E.I.C., K. H. Smith, M.E.I.C.

The retiring chairman then gave his valedictory address as follows:—

Address of Retiring President

In handing over the chairmanship of the Branch to my successor, I wish to thank you very warmly, and to express my high appreciation of the honour that you did me a year ago in giving me a second term in this honourable position.

I wish also to extend my most cordial thanks to the other members of the Executive Committee to whose active interest and hearty co-operation and assistance in every feature of our activities the successful work of the Branch during the past year is due; to the secretary especially my thanks are tendered for his unremitting zeal and thoroughly efficient services.

Let me now congratulate the members of the Branch on their selection of a chairman for the coming year. Being a younger and more vigorous man than his predecessor, I may safely predict, and express the confident hope, that the coming year will be a better and a more successful one than the past in everything that makes for the usefulness of the Branch and the interests of its every member.

In casting about for a specific subject for my valedictory address it occurred to me that it would not be uninteresting, and possibly not wholly uninstructive, to give you a sort of bird's eye survey of the profession as a whole with its various and numerous branches, specialties and ramifications.

First, let me say a word about that much abused and wrongly used adjective, "Civil", as applied to the Engineer. It came into general acceptation about the middle of the eighteenth century, its obvious use being to distinguish an engineer who is not a military engineer, and who conducted works of a non-military character. At or prior to that time the term engineer connoted either a military engineer, whose works embraced the design and construction of fortifications and their concomitants, besides weapons of offense and defence. Many works, however, now carried on by the "civil" engineer were done by the military engineer, such as roads, canals and bridges. The adjective civil was also applied to the engineer who designed and built engines and machinery of various kinds. He is now called a "mechanical" engineer. It is obvious that at the time of the foundation of the Institution of Civil Engineers of London in 1818, the activities of civil engineers embraced the construction of practically every engineering work that was not of a military character, for the charter of the Institution, (dated 1828), defines the aims and functions of the civil engineer as "...the art of directing the great sources of power in nature for the use and convenience of man, as the means of production and of traffic in states, both for external and internal trade, as applied in the construction of roads, bridges, aqueducts, canals, river navigation and docks for internal intercourse and exchange, and in the construction of ports, harbours, moles, breakwaters and light-houses,

F. R. FAULKNER, M.E.I.C.
Chairman of the Halifax Branch.

and in the art of navigation by artificial power for the purposes of commerce, and in the construction and adaptation of machinery, and in the drainage of cities and towns." Thus embracing the works of the mechanical, naval and marine, besides those of what we call the civil engineer.

Curious evidence of the fact that several centuries ago the word engineer meant a military engineer is afforded by Shakespeare:—

" Let it Work
For 'tis the sport to have the Engineer
Hoist with his own petard; and it shall go hard
But I will delve one yard below their mines
And blow them at the moon.
Shakespeare, Hamlet 111, 4"

I wish we could discover or invent a new adjective that would supersede the word "civil" in its application to the engineer, but as this seems hopeless, I suppose we must accept and continue the use of the word as now generally applied.

The whole domain of our profession then is divided into numerous fields to which we give the broad and comprehensive names, civil, mechanical, mining, electrical, military and naval. These fields again are divided into still smaller fields or garden plots. Indeed, it is not easy to define or to limit the specialization and "splitifications" into which the profession is cut up in these modern days. Agreeing perforce to the popularly accepted meaning, the civil engineer is one who is engaged in the design and construction of —

(a) Transportation routes, such as railways, tramways, highways, canals, bridges and tunnels.

(b) Harbours and all their accompaniments, wet docks, and dry docks, wharves, piers, breakwaters, beach protection works, levees, groynes, training weirs and moles for the control and improvement of rivers, whether in the interests of navigation, or the prevention or mitigation of floods.

(c) Systems of water supply and the drainage and sewerage of cities anf towns. Irrigation works.

(d) The development of hydraulic power with all its accessories, such as dams, flumes, conduits, turbines and power wheels of a dozen kinds.

So you see the civil engineer may devote his whole time, energy and skill to any one of a score of specialties each demanding special knowledge, skill and training.

The field of the mechanical engineer is scarcely less wide, his work is the design and construction of machines and machinery of infinite kinds, uses and purposes throughout the whole industrial world, from the ponderous machines that cut and bend, punch and forge the plates and shapes in a rail or rolling mill or shipyard, to the amazingly ingenious and delicate implements that turn out those exquisite fabrics of silks and satins that adorn the so-called weaker sex. One of the most interesting specialities of the mechanical engineer, and one in which he no doubt takes a peculiar pride and pleasure, is the design and construction of airships. Twenty years ago these were scientific freaks or toys, now practical and commercial modes of transport of which it is hard to underestimate the potentialities.

The mining engineer labours in a basement rather than a field. His it is to find and bring to the surface of the earth the treasures hidden below it, the ores, minerals and metaliferous rocks that provide us with a score or two different metals, metallic and metalloid substances, the coal to smelt them and incidentally to fill our furnaces and the coffers of our coal dealer. The successful exploration of his field or basement requires a knowledge of several subjects that are not engineering. He must have a fairly thorough grasp of geology, mineralogy and metallurgy, with at least a smattering of inorganic chemistry and chemical analysis for the identification of metals.

The electrical engineer is a late arrival in the professional arena, but he is getting more important every day. To him we look to produce and deliver the electric current that lights us to bed and which, in the advanced household, cooks our eggs or rasher, makes our toast and boils our coffee in the morning, that irons our shirt and drives our sewing machine, that puts us into instant communication with distant friends and enemies by telephone or telegraph.

On a larger scale and aided by the mechanical engineer he delivers the energy that drives the dynamo that operates the tram that takes us to our office. The electric locomotive, scoffed at in the earlier stages of its development, has come to stay and to multiply. It has solved the difficulty that was rapidly becoming a very serious one, of the smoke and heat in subways, underground railways and tunnels.

I think that now-a-days the field of the electric engineer is almost, if not quite, the largest and most interesting and important in the whole domain of the profession. He has not yet even seen the half of it. Indeed, he may be said to have only just got through the gate. What he will discover and invent, and what he will find to exploit and adapt, when he has explored the further limits of his wonderful specialty, and how and in what ways he will revolutionize many phases of our complex civilization, it simply staggers the imagination to attempt to conceive. The electrical engineer in his constructive activities, and in his applications and adaptations of further wonders and properties of that mysterious something which we call electricity, must follow and wait on the researches and discoveries of the pure scientists, physicists, and electricians. The most astounding of recent marvels in the line of electricity, but due rather to the scientist than to the engineer, is no doubt radio-activity and its development in wireless telegraphy and telephony. In this feature discovery follows discovery in bewildering sequence and frequence. Where will it stop, or rather whither will it lead? For it certainly will not stop. The latest theory of the physicist is that all force and matter are, in the last analysis, mere expressions of electricity.

The military engineer made good his claim to a conspicuous place in the sun during the great war, for during those four awful years he won *kudos* beyond all his former achievements. His special work in the design and construction of fortifications and of engines of destruction was extended to the digging of mines, of trenches and tunnels, the former for defence or shelter and the latter for operations of offense in the laying of mines of high explosives for the discomfiture of the noisome Hun. For many years the engineers of the British army were

called "sappers and miners", because their chief offensive operations in time of war were the sapping and mining of the ennemies' positions. In collaboration with the mechanical engineer he invented and developed the tank, which like some fabled dragon, paralysed the enemy and created such havoc and panic in his ranks. Of it the modern Horace sang:—

> "Victrix per Campos Cisterna vagatur et ecce!
> Viventes pilulos capsula capta vomit."

which may be rendered:—

> "The tank triumphant wanders o'er the fields
> And living pills the captured capsule yields."

Urged by necessity also, the mechanical and the military engineer wonderfully advanced the offense-proficiency of the aeroplane or "dove" as it was playfully called by our friends, the enemey. The general public has but scant knowledge of the tremendously important and valuable part that was played by the military engineer during the war. Our Branch learned something of this from an excellent paper by R. R. Murray, A.M.E.I.C., read at one of our meetings. Among the most important duties of military engineers in peace time is the cadastral, or ordnance, survey of Great Britain, a work of great interest and importance.

The naval or marine engineer, is cousin or half brother to the mechanical engineer. His special and most important job is, of course, the design of engines for the propulsion of vessels afloat, and when you review the progress that he has made since the first steamer of less than 1,000 tons crossed the Atlantic eighty years ago at eight knots, to the present day when "Aquitanias" and "Olympics" of thirty thousand tons do it at twenty-five knots, you will agree that the naval engineer has not lagged behind in the march of professional achievement. The naval engineer also, with the aid of the mechanical and military, has to do with the design of naval artillery and in this specialty remarkable development is seen from the old smooth bore of Nelson's day, that cumbrous, manhandled piece that threw a sixty-four pound round shot nearly a mile, to the fourteen- sixteen- and even eighteen-inch breech loading rifle that projects a high explosive shell weighing nearly a ton for twenty-five to thirty miles. But the naval engineer has other lines of activity besides his propulsive engines and his big guns. The modern Leviathan is full of machinery and mechanical devices, not only in the heating and lighting for the comfort and convenience of the passengers, but for the stowage and handling of cargo, the raising and lowering of anchors, and the warping to a berth. On the general design of the whole complex fabric and the ship the naval or marine engineer and the naval or marine architect and the electrical engineer or electrician are mutually dependent for the elaboration of the complete plan.

But each of the six main branches into which I have attempted crudely to divide our profession, has many sub-specialities, off-shoots or hybrids.

The municipal engineer looks after the comfort and convenience of the dwellers in cities and towns, by seeing that their contributions to the civic exchequer are wisely expended in the construction of streets and roadways, sidewalks and pavements, tracks and facilities for inter-urban traffic by tramways operated by electricity, cable, or the almost forgotten horse. With the aid of the electric engineer or electrician he sees to it that our streets and houses and public buildings are properly lighted; that an efficient system of water supply delivers an adequate quantity of oxide of hydrogen for domestic and manufacturing purposes, and for the extinguishing of fires, to reduce our fire premiums. He designs and builds sewers and drains for the rapid and thorough removal of all liquid residua and crematories and garbage incinerators for the reduction to innocuous ash of all solid refuse.

The chemical engineer is perhaps a more highly scientific man than many of his professional confreres. His interesting duty is, in conjunction with the chemist and the mechanical engineer, to design and build works and plant and machinery for the manufacture of the innumerable chemical substances and products that enter so largely not only into our industrial life, but also into other phases of our complex modern existence. His growing importance as a promoter of agricultural process is very strikingly shown by an electro-chemical industry that has sprung up within the past quarter of a century and which is of such scientific and commercial interest that it deserves at least a passing notice.

In 1892, Sir William Crooks showed that by passing a strong induction current between terminals, the air took fire under the intense heat of the electric arc and continued to burn with a powerful flame, producing nitrous and nitric acids. In his address to the British Association in 1898 he said, "This inconsiderable experiment may not unlikely lead to the development of a mighty industry destined to solve the great food problem." He was a prophet. A few years later the first successful nitrate factory was established at Notodden in Norway, on the banks of a powerful stream which actuated a battery of electric furnaces of 800 h.p. each. An alternating current of 3,000 to 5,000 volts is passed through the electrodes and a powerful electro-magnet blows the arc into a rotary disc of flame, six feet in diameter, consisting of burning nitrogen and oxygen. The resulting gases, which contain two-thirds of one percent of nitrous oxide, are pumped off, and through a further series of processes, there is formed calcium nitrate and nitrite, which can be used directly as fertilizer. Sir Wm. Crooks' experiment was an imitation of the lightning flash by which throughout the world more than four hundred million tons of nitrogen are yearly combined and washed into the surface of the earth by rain. In this way most of the combined nitrogen in the soil and in all living things has been obtained from the air.

The sanitary engineer has to do with the works and structures and appliances and mechanical devices that make for and safeguard the health of the community. The scientific disposition or treatment of sewage or refuse by converting it into something either useful or harmless, fertilizer, inert ash or sterilized effluent, by the use of sedimentation tanks, sludge compressors and driers or incinerating furnaces. He designs, on scientific principles, the whole elaborate system of plumbing for very large buildings of many kinds and uses.

The hydraulic engineer, as his adjective implies, has to do with running water, whether in rivers, aqueducts, flumes, conduits or pipes. His works, which, however, are for the most part carried on by the civil engineer, who rarely specializes himself by the title hydraulic, are the regulation and adjustment of the regimen of rivers and streams with a view to the improvement of navigation or the prevention of floods by means of dams, weirs or levees. He develops the power of falls and rapids by turbines and other wheels. To him we owe the evolution of the modern high efficiency unit of 75 to 80 percent with its ten to twelve thousand h.p. from the ancient, cumbrous, over- or undershot wheel with its 10 to 12 percent efficiency and twenty or thirty horse power.

The heating engineer and the ventilating engineer, generally and properly in one person, is a man of no little importance in the design and operation of large city edifices, such as hotels, office buildings, and theatres.

The steam engineer is a sub-specialist of the mechanical. He is supposed to design and operate engines driven by steam, with their attendant boilers; to study and experiment on their mutual relationships, to record diagrams and full and minute operative particulars with a view to the increased efficiency of the engine, using a given quantity and pressure of steam, and the minimum cost of fuel and attendance. It is in this line of mechanical activity that we often come across an improper use of the title engineer. The man who drives a locomotive or even a little 3 or 4 h.p. steam or gasoline engine, or he who looks after the furnaces in large buildings, is in popular parlance, an engineer. It is easier to draw the line between the engineer and the non-engineer — though this is often difficult — than it is to get the public to see it. I take it that the man who can design and build an engine, understand the scientific principles underlying its construction and operation, is an engineer, and the man who merely manages, operates or repairs it is a mechanic, machinist or mechanician.

The forest engineer's function is to provide one of the most indispensable materials, and his work and usefulness are coming into deserved recognition by the establishment in many countries of departments and bureaus of forestry, and of schools and colleges for the study of the best methods of preserving our forests and of stimulating tree growth in arid and other hitherto unsuitable soils and situations.

Thus we see that the many fields into which the whole profession is divided have no clearly defined boundaries or barbed wire fences separating each from the other. They all lap or interlock more or less, and are surrounded on all sides by strips or common margins of professional and technical activities where two or often several specialists meet for their mutual aid and advantage.

I have described at somewhat greater length than may have interested you the various leading types and classes of professional engineers and their respective and particular lines of work. I have done so because I think it important, or anyhow desirable, that at this juncture in the progress and status of our profession, we should have a clear idea, as to what an engineer is, and also as to what he is not.

The public has never had much trouble in distinguishing between doctors and laymen, or between lawyers and laymen, because for centuries their respective occupations have been clearly defined and universally recognized as learned professions. Before doctors and lawyers are admitted to practise they are compelled to pass through protracted and well defined courses of study, and they must produce certificates or diplomas of knowledge and proficiency. Once admitted they are protected by law from the rivalry of unqualified men. It is only within the past three or four years, after twenty odd years of effort, that we have won this last advantage. It may also be noted in this connection that you can make a doctor or a lawyer within the four walls of a building, but in the making of an engineer, after he has had four or five years of special education, theoretical and technical, he must spend an equal period in the field before he can be recognized or admitted to practise as a full-fledged practitioner. Incidentally it may be noted that doctors and lawyers have certain advantages over us. A lawyer's mistakes generally serve but to make more litigation, to bring more grist to the legal mill. The doctor's mistakes are generally buried five or six feet under-ground. If an engineer makes a mistake, especially if it results in loss of life or money, his professional career is either seriously prejudiced or at an end.

The Engineering Institute of Canada was established thirty-five years ago but it is only within the past six or seven years that local and provincial Branches have been formed. This policy has, up to the present time, at any rate, abundantly proved the wisdom of its adoption, for in the twenty-two cities and towns, from Sydney to Victoria, in which Branches have been organized, every engineer within the radius of activity of each Branch is made to feel that he has a direct personal interest in *The Institute*, and that *The Institute* has a direct interest in him. There is no doubt that the formation of Branches has been of enormous advantage, not merely to the profession at large, but to every member of *The Institute.*

The most portentous step in advance that has ever been made by the profession in Canada was the creation and incorporation in nearly every Province, by acts of legislature, of Associations of Professional Engineers to prevent, by legal enactment, the practice of engineering by incompentent and unqualified men, but while these Associations are expected to be of material benefit to every engineer in the country — and bear in mind that they have not yet passed the experimental stage — their establishment brings corresponding responsibilities. The proper, but not sole or compulsory avenue to membership in an Association, and so to the legal right to practise engineering, is through the E.I.C. It would be difficult and, in most cases, improper for an association to refuse registration to a member of the E.I.C., therefore, it is the serious and obvious duty of the E.I.C. and of its every Branch and every member to see to it that no man is admitted to any class of *The Institute* unless, or until, he is possessed of all the qualifications laid down in our Constitution and By-Laws. It is only by loyal and whole-hearted co-operation in the functions and activities, and by sharing and bearing the responsibilities, of both the Branch and the Association in our respective Provinces that we shall advance our collective or indivudual interest or be worthy members of the best of all professions.

A hearty vote of thanks was moved by Messrs. Bowman and Allen for the splendid service and untiring effort on the part of Mr. Dodwell in the interests of the Branch ever since its inception. Various points in the chairman's excellent address gave rise to considerable discussion, and a very profitable and enjoyable hour was spent in discussing engineering problems and ways and means of furthering the interests of the Branch and the profession at large.

Victoria Branch

Horace M. Bigwood, A.M.E.I.C., Secretary.

Probably the most interesting paper read before the Branch during the season was the one on "The Scientific Making of Concrete" by Professor Duff A. Abrams on Wednesday, May 31st.

Professor Abrams who is director of the Structural Materials Research Laboratory, of the Lewis Institute, Chicago, dealt fully with the work done at the laboratory in the direction of determining the most suitable combination of cement and aggregates to obtain the best results. Several curves and charts were shown as indicating the results attained with various mixtures and with varying proportions of water, which latter the lecturer stated had a very great influence on the resulting concrete; as little water as possible to obtain a plastic mixture being most desirable. The meeting was well attended by *Institute* members and several contractors and architects well known in Victoria were also present. A number of lantern slides of examples of concrete construction were also shown.

As a sequel to the lecture and to follow the principle of visiting work closely connected with the same subject as previously discussed, a visit was made to the works of the B.C. Cement Company at Bamberton on June 2nd, the party being conducted over the plant by the manager, Mr. Tomlin, and the superintendant, Mr. Anderson. The method of manufacture, by the wet process, was fully explained and demonstrated. Before proceeding to the works lunch was partaken of at the Brentwood hotel, when, while lighting up afterwards, Capt. Everall recalled his trenches days by sending up a "flare" in the shape of a match holder full of matches, head up, which he touched off by drawing the one he intended to use, upwards. The result was most effective. No casualties.

Victoria Branch visits Bamberton Cement Works.

Canadian Good Roads Association Convention.

The ninth annual convention of the Canadian Good Roads Association, of which a more detailed account appears elsewhere in *The Journal* is in full swing, at time of writing, in Victoria and there are many *Institute* members in attendance. From Victoria the majority of the visiting members are expected to go on to Vancouver to attend the Western Professional meeting of *The Institute*, together with many local members.

Edmonton Branch

R. H. Douglas, A.M.E.I.C., Secretary-Treasurer.

A meeting of the Branch was held in the Board of Trade rooms at 5 p.m. on Tuesday May 23rd, for the purpose of completing the election of officers of the Branch for the season of 1922-23. The result of the ballot was as follows:—Chairman, J. G. Reid, M.E.I.C.; Vice-Chairman, E. Stansfield, M.E.I.C.; Sec.-Treas.' R. H. Douglas, A.M.E.I.C.; Executive: W. R. Mount, A.M.E.I.C., J. D. Robertson, A.M.E.I.C., R. W. Ross, A.M.E.I.C., A. Stewart, A.M.E.I.C.; (*Ex-Officio:*) C. A Robb, A.M.E.I.C., R. S. L. Wilson, A.M.E.I.C.

On June 8th the Branch held a joint meeting with the Engineering Section of the Board of Trade at which Professor Duff Abrams of the Lewis Institute gave his illustrated lecture on "Scientific Methods of Making Concrete". Over a hundred attended and received much valuable information from Professor Abrams' talk.

* * *

"*Moments and Stresses in (concrete) Slabs*" a valuable report contributed by H. M. Westergaard, Assistant Professor of Theoretical and Applied Mechanics, University of Illinois, and W. A. Slater, Engineer Physicist, United States Bureau of Standards, to the Proceedings of the American Concrete Institute, vol. 17, 1921, 124 pp. has just been made available to those who desire separate copies. The National Research Council, on request, has reprinted the report as Number 32 of its *Reprint and Circular Series.*

This report contains so much information of value to engineers designing and building reinforced concrete structures that a number of men who are authorities in this field recommended that the report be given wider circulation than the limited small edition of the Proceedings. Further information regarding this publication may be secured from the Publication Office, National Research Council, 1701 Massachusetts Avenue, Washington, D.C.

OTHER SOCIETIES NEWS

Canadian Good Roads Association

The ninth annual convention of the Canadian Good Roads Association, being the Pacific Coast Goods Roads Convention, was held at the Empress Hotel, Victoria, B.C., June 12th to 15th inclusive, in co-operation with the Good Roads League of British Columbia and other western Good Roads associations. As is usual at such conventions, *The Institute* was largely represented by those present and members of *The Institute* took a prominent part both on the organization and entertainment committees, while in the papers and addresses given they were the dominating feature. Among the papers presented by members were,—

"Drainage Methods for Prairie Roads" by H. R. MacKenzie, A.M.E.I.C., Chief Field Engineer, Province of Saskatchewan;

"Federal Aid, its Implications and Results" by A. W. Campbell, M.E.I.C., Chief Commissioner of Highways, Dominion Government;

"How to Improve Earth, Clay and Sand Roads" by J. D. Robertson, A.M.E.I.C., Deputy Minister of Public Works, Province of Alberta;

"Cement Concrete Roads"—Discussion by A. E. Foreman, M.E.I.C., District Engineer, Portland Cement Association, Vancouver;

"Road Machinery" by A. L. MacPherson, A.M.E.I.C., Department of Public Works, Victoria;

"Colonization Roads" by W. F. Fullerton, M.E.I.C., Superintendent of Colonization Roads, Province of Ontario.

"Provincial Highways" by Patrick Philip, M.E.I.C., Chief Engineer of Public Works of B.C.

"Asphaltic Concrete Pavements"—Discussion by Charles Mullen, Consulting Paving Engineer, Montreal.

"Foundations" by J. A. Duchastel, M.E.I.C., Manager and City Engineer, Outremont, with discussion by A. F. McCallum, M.E.I.C., Commissioner of Works, City of Ottawa.

"Surface and Sub-soil Drainage" by W. A. McLean, M.E.I.C., Deputy Minister of Highways, Province of Ontario.

"Road Dragging and Maintenance Competition" by H. S. Carpenter, M.E.I.C., Deputy Minister of Highways, Province of Saskatchewan.

As a means of furthering the stated objects of the Canadian Good Roads Association, a resolution introduced by Captain Duchastel was adopted, requesting the co-operation of the Canadian Engineering Standards Association in collecting information and data dealing with roads and road improvements and in recommending standards both of materials and practice for the benefit of the municipalities and provinces of the Dominion.

The Honourable Joseph L. Perron, K.C., of Montreal, Minister of Roads of the Province of Quebec, was elected president of the Association. Other officers elected were:—

Honorary president, S. J. Latta, Regina; first vice-president, Russell T. Kelley, Hamilton; second vice-president, F. L. Fellowes, Vancouver; secretary-treasurer, G. A. McNamee, Montreal; directors, Mayor Jos. Beaubien, Outremont; H. S. Carpenter, A.M.E.I.C., Regina; Wm. Findlay, Toronto; Geo. Hogarth, M.E.I.C., Toronto; J. D. Robertson, A.M.E.I.C., Edmonton; P. Philip, M.E.I.C., Victoria; S. H. Henderson, Winnipeg; G. F. Pearson, Halifax; R. D. Patterson, St. John; A. M. Rankin, M.P.P., Collins Bay, Ont.; T. J. Mahoney, Hamilton; H.H. Shaw, A.M.E.I.C., Charlottetown; J. A. Duchastel, M.E.I.C., Outremont, Que; P. Gommery, Vancouver; R. H. Murray, Halifax.

The following corporate members of *The Institute* were registered in attendance:—

F. W. Anderson, M.L.A., Kamloops, B.C.; C. Brackenridge, Consulting Engineer, Vancouver, B.C.; H. M. Bigwood, Chief Dftsman., P.W. Dept., Victoria, B.C.; J. W. B. Blackman, City Engineer, N. Vancouver, B.C.; C. E. Cartwright, Civil Engineer, Vancouver, B.C.; M. T. Cotton, Engineers and Contractors, Vancouver, B.C.; A. L. Carruthers, Dist. Engr., Prov. P. W., Prince Rupert, B.C.; H. S. Carpenter, Deputy Minister of Highways, Regina, Sask.; A. W. Campbell, Dom. Commissioner of Highways, Ottawa, Ont.; A. Dixon, Dist. Engr. D.P.W., South Fort George, B.C.; J. A. Duchastel, Chief Engr., and Manager, Outremont, Que.; A. E. Foreman, Dist. Engr., Portland Cement Assoc., Vancouver, B.C.; C. F. P. Faulkner, Victoria, B.C.; J. P. Forde, Dist. Engr., Dept. P.W. Canada, Victoria, B.C.; R. Fowler, Municipal Engr., Oak Bay, Victoria, B.C.; C.H. Fullerton, Supt. of Roads, Toronto, Ont.; J. M. Finlayson, Prof. of C.E. University of Manitoba, Winnipeg, Man.; P. Gillespie, Prof. of C.E., University of Toronto, Toronto, Ont.; W. B. Greig, Municipal Engr., Point Gray, Vancouver, B.C.; W. K. Gwyer, Dist. Engr. Dept. P.W., Penticton, B.C.; Col. A. E. Hodgins, Dist. Engr. Dept. P.W., Victoria, B.C.; J. B. Holdcroft, Rep. Contract Record, Victoria, B.C.; Fraser S. Keith, Gen. Secy., *The Engineering Institute of Canada*, Montreal, Que.; P. J. Jennings, Asst. Commissioner of Irrigation, Dept. of Interior, Calgary, Alta.; H. R. MacKenzie, Highway Engr., Regina, Sask.; W. A. McLean, Deputy Minister of Highways, Toronto, Ont.; F. L. MacPherson, Official Engr., Dept. P.W., Victoria, B.C.; Chas. A. Mullen, Consulting Engr.,; Montreal, Que.; E. G. Matheson, Prof. of C.E., University of B.C., Vancouver, B.C.; A. F. Macallum, Commissioner of Works, Ottawa, Ont.; Wm. Pearce, Dept., of Colonization and Development, C.P.R., Calgary, Alta.; P. Philip, Public Works Engineer, Victoria, B.C.; T. Rognaas, Resident Engr., Road Assoc., Victoria, B.C.; J.D. Robertson, Deputy Minister of P.W., Edmonton, Alta.; Wm. Ramsay, Dist. Engr., Dept. P.W., Nelson,

B.C.; J. M. Rolston, Vancouver, B.C.; H. Stewardson, City Engineer, New Westminster,; G. W. Tornroos, Civil Engr., Vancouver, B.C.; T. H. Tracey, Alderman, Vancouver, B.C.; H. S. Van Scoyoc, Canada Cement Co., Montreal, Que.; J. M. Wardle, Chief Engr., Can. Nat. Parks, Ottawa, Ont.; A. A. Young, Engr., Winnipeg, Man.

Canadian Institute of Chemistry

The first book of the Canadian Institute of Chemistry, containing the Constitution, By-laws and List of Members, bears record to the splendid progress resulting from the untiring efforts of those men of Science who conceived the idea and made possible this much needed organization. To this new Institute and to its members, *The Engineering Institute of Canada* extends its most hearty good wishes and congratulations.

The first attempt to secure co-operation between chemists in Canada was made some thirteen years ago by the late Dr. J. P. Girwood, F.I.C. but without definite results. In 1918, following an address by Professor Matthew A. Parker, of the University of Manitoba, before the annual meeting of the Canadian Section of the Society of Chemical Industry, a lively discussion took place as a result of which the chairman of the Canadian Section of the Society of Chemical Industry appointed a committee known as the Chemists Organization Committee, with Professor Parker as chairman and Harold J. Roast as secretary. After a year of steady work, the preliminary report of this committee was made public and correspondence invited. With slight changes and additions, this report was presented as a final report to the Convention of Chemists held in May 1919, at Montreal, under the auspices of the Canadian Section of the Society of Chemical Industry, the local chairman of the Society, Dean Goodwin, of Kingston, being in the chair. With slight modifications, the report was adopted; a nucleus of members elected; and subsequently the first Council elected. In May 1920, at the first annual meeting, held in Toronto, the By-laws were adopted and on August 15th, 1921, the Institute was incorporated as a Dominion Body. At the first of the present year, the Institute had a total membership of 257 as follows:— Honorary Fellows 2; Fellows 166; Associates 39; Students 50.

Chemists in Annual Meeting

At the annual convention of Chemists, held in Ottawa the registration numbered 100 and the meetings of both the Society of Chemical Industry and of the Canadian Institute of Chemistry were all attended.

At the annual meeting of the Society of Chemical Industry, the president, Dr. R. F. Ruttan and vice-president, Theo. H. Wardleworth, were present. Dr. Ruttan is the first Canadian to have been elected to the presidency of the Society of Chemical Industry which organization has on its rolls more than 6,000 members resident in all parts of the world.

The Canadian Institute of Chemistry was incorporated under Dominion Letters Patent in 1921. It is a purely professional organization, created for the purpose of providing machinery whereby the status of the profession of chemistry in Canada might be improved. At the annual elections Professor J. Watson Bain of the University of Toronto retired after two years in office and Dr. John S. Bates, A.M.E.I.C., of the Bathurst Lumber Company, Bathurst, N.B. was elected. Harold J. Roast, secretary since the inception of *The Institute*, retired and was succeeded by L. E. Westman, editor of Canadian Chemistry and Metallurgy, Toronto.

The programme included many papers of interest to the profession among, which were, "The Operation of Koppers By-Produce Oven Plant" by C. E. Wallin, B.A., of the Dominion Iron and Steel Company., Sydney, N. S.; "Analytical Problems in the Metallurgy of Nickel" by E. E. Lathe, M.Sc., of the British America Nickel Corporation, Deschenes, P.Q.; "Soil Corrosion of Iron and Lead" by Dr. J. W. Shipley, University of Manitoba, Winnipeg; "Chemical Products from Natural Gas" by R. T. Elworthy, B.Sc., Department of Mines; "The Constitution of Rubber" by Dr. M. C. Boswell, University of Toronto; "The Education of the Chemist from the stand-point of The Institute" by Dr. L. F. Goodwin, Queens University, Kingston; "How The Institute can best serve the Canadian Chemist" by Dr. J. S. Bates, Bathurst, N.B.; "The Best Method of Handling Publicity for the Chemical Profession" by W. C. Lodge, Montreal.

Canadian Electrical Association Annual Convention

The Canadian Electrical Association held their thirty-second annual convention in Ottawa, on June 15th, at which many members of *The Engineering Institute* were present. In his address, as president, Julian C. Smith, M.E.I.C., stated, as evidence, of the material good resulting to the nation from electrical development, that each year Canada was adding 200,000 horse-power to that already in use. This meant a capital expenditure of $40,000,000 per year. He was hopeful that within a year the question of financing would be relieved.

The industrial strength of any nation was to be judged by the per capita use of power and Canada was fast changing from an agricultural country to a nation of industries, and on that ground the use of power and its development should be encouraged.

Short talks were also given by John Murphy, M.E.I.C., Ottawa; J. B. Woodyatt, A.M.E.I.C., Montreal; and K. Pyke, Montreal.

At the luncheon, which was presided over by the president,.the speaker was, A. Munro Grier, K.C., and his remarks were listened to with interest whenever, through the applause, they could be heard. Mr. Grier is a past president of the association, and in choosing a subject for his address he decided to call it "Loyalty," although, as he said, it might carry many names. "The most loyal man to the association," said the speaker, "was not the man who thought all the virtues were resident in the association. Those who best served were those whose heart and soul were alive to the virtues of others.

The man who loved his country because he hated all others was not the best citizen." Loyalty was something that came down from the top to the bottom, and then spread up to the top again. He spoke of the importance of personal loyalty in business, and this carried out meant a great increase in business efficiency. "We in Canada," he said, "have no right but to do our best." The man who thought his country fine and noble would not only boost, but would do his best. The heritage handed down to us and shared by the American people from the same stock, the heritage of fineness of character, is such that we have no right to be small and mean; we must be worthy of the Empire to which we belong.

In the evening D'Arcy Ryan gave a very interesting address on "Illumination," reviewing the subject from its earliest known history, — the crude lamps of the cave dwellers to the magnificent lighting of the San Francisco Exposition, of which latter Mr. Ryan was the engineer. Mr. Ryan is a Canadian by birth and has devoted his life's effort to study and research in the science of illumination. The results of his creative genius in lighting are in nearly every great city of the world and in the new world, particularly. He has just recently returned from Rio de Janeiro, where he has installed the illumination system for the Brazilian Exposition.

Corporation of Professional Engineers of Quebec

The official list of members of the Corporation of Professional Engineers of Quebec for 1922, which contains about eight hundred names, is at present being printed and will be distributed to all Courts of Justice, the secretaries of all towns and cities in the Province, the railways and the larger corporations, as well as to each member.

Canadian Engineering Standards Association.

Seventh Meeting of the Main Committee.

The seventh meeting of the Main committee of the Association was held in Ottawa at the offices of the Association on the 24th of April, H. H. Vaughan, M.E.I.C., in the chair. This meeting being the first held since the death of Sir John Kennedy, Hon. M.E.I.C., the resolution of condolence which was passed by the committee in November last was reported as having been forwarded to Lady Kennedy, and the chairman and other members of the committee spoke feelingly of the loss sustained by the Association through Sir John's death.

The following changes in the personnel and renominations of members of the Main committee were reported:— Sir Alexander Bertram, M.E.I.C., nominated by *The Engineering Institute of Canada*, replacing W. F. Tye, M.E.I.C.; O. W. Lefebvre, nominated by the Ecole Polytechnique, replacing A. Surveyor, M.E.I.C.; Dr. L. A. Herdt, M.E.I.C., renominated by McGill University; Dr. R. A. Ross, M.E.I.C., renominated by the Research Council; Prof. P. Gillispie, M.E.I.C., renominated by the University of Toronto; T. F. Sutherland, renominated by the Canadian Institute of Mining and Metallurgy; A. R. Goldie, renominated by the Canadian Manufacturers' Association. W. A. Bowden, M.E.I.C., having been nominated as a member of the Main committee by the Department of Railways and Canals, replacing Colonel Monsarrat, M.E.I.C., it was decided to co-opt Colonel Monsarrat as a member so as to retain his services on the committee.

The following were unanimously elected as the officers of the Association for the coming year, and as such, constitute the Executive committee; Chairman, H. H. Vaughan, M.E.I.C.; Vice-Chairman, T. A. Russell and D. H. McDougall, M.E.I.C.; Honorary Secretary-Treasurer, Dr. J. B. Porter, M.E.I.C.

Standard Specifications for Steel Railway Bridges.

The Association has recently added another valuable volume to its list of publications in the new Standard Specifications for Steel Railway Bridges, which is now available for distribution. The first edition of these specifications was issued in 1920 and has since been exhausted. The present edition embodies certain changes in the revision, re-arrangement and expansion of a number of clauses, while the section dealing with moveable bridges, which appeared in the former edition, has been withdrawn and is at present being prepared as a separate specification for moveable bridges.

Town Planning Notes and Comments

Horace L. Seymour, A.M.E.I.C.

NOTE. — *In order to make this column of wide interest to members of The Institute, personals and items of town planning interest will be appreciated. Address: Horace L. Seymour, A.M.E.I.C., 40 Jarvis Street, Toronto.*

The fourteenth annual meeting of the National Conference on City Planning was held this year from June 5th to 7th., at the city of Springfield, Mass. Of the various Town Planning organizations in North America, this National Conference on City Planning is undoubtedly the most important. Canada's quota this year was a small one but included A. E. K. Bunnell, A.M.E.I.C., managing engineer of the Toronto Civic Guild and A. V. Hall, landscape architect, Toronto.

In the advance notice of the meeting there were mentioned several matters that are of particular importance. One is, that every city in the United States with a population of over 300,000 has adopted city planning as a part of its official program. The other matters deal with those features of recent development in town planning — the garden city and regional planning.

Mariemont, a complete town, is to be built near Cincinnati, Ohio, as an exemplar of planning ideals after the fashion of Letchworth, England, but with American adaptations. "Its success," says the circular on National Conference on City Planning, "will revolutionize city living." The same circular draws attention to the development in regional planning.

In view of the importance attached to the garden city and to regional planning, it is considered that some information might be given in these pages.

The Garden City

The June issue of "Garden Cities and Town Planning," (England), states in the "Editorial Comments" under the caption of "The Importance of the Man in the Street":

"The future of the town planning movement — which is full of hope — depends upon the man in the street. He, at last, is formulating some sort of opinion on town planning; he knows now that it is not a political dodge, nor an aesthetic fad, but a practical proposition, which will pay dividends, partly in human happiness — the possibility of which always interests him — and partly in hard-cash rebates on rates and taxes — the necessity of which comes second only to that of personal liberty as his most deeply-rooted conviction. In spite of all the discouragements of this post-war period, he is advancing rapidly on a line of thought which might be termed "**the road to Letchworth.**" Foreign travel — the Kaiser became in 1914 the greatest tourist agent in history — taught him that civilization can express itself in terms other than town agglomerations; the talk of reconstruction made him conscious that there was much to reconstruct; his very disappointments have made him realize that, if reconstruction be so difficult, fresh construction must be regulated to prevent any early necessity of its being done all over again."

In the same issue of this magazine there is an article entitled, "How to get Garden Cities established throughout the World". This is taken from a paper presented to the Conference of the International Garden Cities and Town Planning Association at Olympia, England, March 15th, 1922. Some extracts from this article are of exceeding interest:

"The garden city movement is different from all other movements for the improvement of cities and the revival of rural life, in that it rests upon the conception of a new form of town structure with a definite economic basis. The garden city is a town — not a village or a suburb or a housing scheme — functioning as a social organism, the economic foundation of which is control of its own land values."

"The garden city movement would not have survived in England had Letchworth not been founded; and the movement has greatly revived since Welwyn Garden City was started eighteen months ago. Examples of garden cities in the various counties of the world would do more to bring the movement into the first place as an international force than anything else. These examples should not be expected to follow the exact pattern of Letchworth or Welwyn Garden City. There is no set type of garden city plan. Each national garden city should be designed in accordance with national taste and economic needs. But it is important, if the example is to have any value, that a true garden city should be aimed at. It must, at least, fulfill the following conditions:

"It must be a town, large enough to have all the features of a town characteristic of the country in which it is placed. It must provide for all classes of the community, so that it may possess a sound civic being. It must provide for industry to be carried on. It must be planned as a whole. It must combine rural interests with urban interests. Finally it must **control** the whole of the land which it is built and surrounding it."

It might be mentioned that a garden city is one that is definitely limited in extent, its boundaries being determined by a permanent agricultural belt or zone of land surrounding the city. The only way it can be enlarged is by the creation of another unit. To those who see the menace to health and happiness of the big city, the garden city will no doubt appeal. A Premier of one of our provinces recently remarked that he would rather have fifty cities of 10,000 each than one city of 500,000.

The article, referred to above, mentions that "At present there are two garden cities in progress in England, there are none elsewhere." In view of this, the announcement in regard to Mariemont is interesting, also the fact that the garden city idea is to be adapted in part at least to an existing town in Florida — Coconut Grove. There is proposed a productive park strip owned by the municipality, surrounding the heart of the town.

Regional Planning.

The proceedings of the First Regional Planning Conference of Los Angeles County, California, held at Pasadena, January 21st., 1922, are worthy of study:

"In the city planning work of Los Angeles city, and presumably in surrounding cities, it was early recognized that large though the city was the efficacy of its planning work was largely interfered with through limitations imposed by the existence of arbitrary municipal boundaries. Consideration of city planning problems at once evidenced the fact that the origin of some problems was to be found largely in communities or areas beyond the corporate limits of the city and outside of the munucipality's jurisdiction. It was obvious that the solution of problems thus arising was dependent largely to the degree that co-operation could be effected between the communities jointly contributing to or suffering from the problems. Prominent among the subjects thus considered was that of transportation, with reference both to rapid transit by rail and the ever increasing utilization of the motor vehicle over the boulevards. Another subject of primary importance was the supervision of new subdivisions through the means of which not only Los Angeles but the whole metropolitan area is rapidly being converted from raw country land into city property. The need for a unification in standardized requirements and standardized procedure in this subject was early manifested. A third subject of the many, and of primary importance, was the matter of sanitation as applied especially to sewage disposal. The interdependence of municipalities in this respect has been, and is increasingly becoming, especially apparent."

The proceedings of this conference include reports on the following subjects: Highways, Subdivisions, Transportation, Sanitation, Flood Control, Parks and Boulevards, Zoning, Legislation, Finance, Water Supply and Topography, which were contributed by prominent engineers. The Special Sewage Disposal Commission numbers amongst its members George W. Fuller of New York city and George C. Whipple of Cambridge, Mass.

According to the June issue of the "American City" magazine — on the initiative of the Russell Sage Foundation a committee has been appointed for the "Plan of New York and its Environs". This announcement was made on May 10th, 1922 at a meeting held in the Engineering Societies building, at which were present architects, engineers, artists, town planners and community workers. Amongst the speakers was Herbert Hoover who, we are always glad to remember, is an engineer. He said in part:

"The enormous losses in human happiness and in money which have resulted from lack of city plans which take into account the conditions of modern life, need little proof. The lack of adequate open spaces, of playgrounds and parks, the congestion of streets, the misery of tenement life and its repercussions upon each new generation, are an untold charge against our American life. Our cities do not produce their full contribution to the sinews of American life and national character. The moral and social issues can only be solved by a new conception of city building.

The vision of the region around New York as a well-planned location of millions of happy homes and a better working centre of millions of men and women, grasps the imagination. A definite plan for its accomplishment may be only an ideal. But a people without ideals degenerates — one with practical ideals is already upon the road to attain them."

The area to be planned for will provide for an urban population of thirty-seven millions.

An Act Respecting Professional Engineers

His Majesty, by and with the advice and consent of the Legislative Assembly of the Province of Ontario, enacts as follows:—

1. This Act may be cited as "The Professional Engineers' Act, 1922".

2. In this Act.

(a) "Association" shall mean the Association of Professional Engineers of the Province of Ontario.

(b) "Board" shall mean the Board of Examiners of the Association.

(c) "Council" shall mean the Council of the Association.

(d) "Licensed" shall mean that permission has been granted by the council to a non-resident engineer to practise temporarily without being registered, and "License" shall mean the official certificate under the seal of the Association evidencing such permission.

(e) "Member" shall mean a Registered Member of the Association.

(f) "President" shall mean the President of the Association.

(g) "Professional Engineering" save as hereinafter mentioned, shall mean the advising on, the reporting on, the designing of, the supervising of the construction of, all public utilities, industrial works, railways, tramways, bridges, tunnels, highways, roads, canals, harbour works, light houses, river improvements, wet docks, dry docks, floating docks, dredges, cranes, drainage works, irrigation works, waterworks, water purification plants, sewerage works, sewage disposal works, incinerators, hydraulic works, power transmission, steel, concrete and reinforced concrete structures, electric lighting systems, electric power plants, electric machinery, electric apparatus, telephone systems, telegraph systems, cables, wireless plants, mineral property, mining machinery, mining development, mining operations, gas and oil developments, smelters, refineries, metallurgical machinery, and equipment and apparatus for carrying out such operations, machinery, steam engines, hydraulic turbines, pumps, internal combustion engines and other mechanical structures, chemical and metallurgical machinery, apparatus and processes, aeroplanes, air ships, and all other engineering works.

(h) "Registered" shall mean that an engineer has been admitted to membership in the Association and that his name has been enrolled in the register; and "Certificate of Registration" shall mean the official certificate under the seal of the Association evidencing the same.

(i) "Registrar" shall mean the Registrar of the Association.

(j) "Secretary" shall mean the Secretary or the Secretary-Treasurer of the Association.

(k) "Vice-President" shall mean the Vice-President of the Association.

3.—(1) All persons registered as professional engineers under the provisions of this Act shall constitute the "Association of Professional Engineers of the Province of Ontario" and shall be a body politic and corporate, with perpetual succession and a common seal.

(2) The head office of the Association shall be at the City of Toronto.

(3) The Association shall have power to acquire and hold real or personal property not producing at any time an annual income in excess of $10,000, and to alienate, mortgage, lease, or otherwise dispose of such property or any part thereof as occasion may require.

(4) All fees, fines and penalties receivable and recoverable under this Act shall belong to the Association.

4. The Association may pass by-laws not inconsistent with the provisions of this Act for:—

(a) The election of "Council".

(b) The government and discipline of the members.

(c) The management of its property.

(d) The appointment of such officers as may be necessary for carrying out the purposes of the Association;

(e) The maintenance of the Association by fixing, levying and collecting the necessary fee from each member and licensee, which fee shall not exceed $10 per annum;

(f) The admission of candidates to registration;

(g) The keeping of the "register";

(h) Fixing dates and places of meetings of the "Association."

(i) All such other purposes as may be deemed necessary or convenient for the management of the association, or the conduct of its business.

5. No by-law of the association or amendment thereto shall be valid or take effect until approved by the Lieutenant-Governor in Council.

6.—(1) For purposes of representation upon the council and for registration, and for such purposes only as are hereinafter set out, membership of the association shall be subdivided into the following branches: Civil Engineers, mechanical engineers, chemical engineers, electrical engineers, mining engineers.

(2) Each member admitted to the association may register in all branches for which he can submit credentials satisfactory to the authority governing admission to each of such branches, but he shall, however, vote in only one such branch according to his own selection, but may transfer his vote to some other branch in which he is registered, upon the approval of the council.

7. Additional branches may be established by the Lieutenant-Governor in Council upon the petition of not less than 100 registered members of the association, provided such petition be approved by the council, or upon petition of 200 members of the association if such approval be not obtained.

8.—(1) The council shall consist of a president, a vice-president, an immediate past-president and three councillors from each branch of the association, all of whom shall be registered members of the association.

(2) The president, who shall be elected annually by vote of members, shall hold office until his successor is elected, shall act as presiding officer at the meetings of the council and of the association, voting only when the votes are evenly divided, and on his retirement shall hold office as councillor for the next year succeeding.

(3) The vice-president shall be elected annually by vote of members, and shall have all the powers of the president during the absence of the latter.

(4) The councillors shall be elected annually from each branch of the association by the vote of the registered members in such branch and one councillor from each branch shall be appointed by the Lieutenant-Governor in Council.

(5) The council shall appoint a registrar and a secretary who shall hold office during the pleasure of the council.

9.—(1) The members of the council representing each branch shall control, subject to the terms of this Act, the conditions for registration and for licensing in such branch, including credentials, examinations and exemptions.

(2) The council as a whole shall have the power to review the establishment of and the carrying out of the conditions for registration as administered by the representative councillors from all branches, and shall have the power to require the representatives of such branches to modify their administration in order to maintain a standard of qualification in members satisfactory to the council.

(3) The revocation of certificates and the reissuing of such certificates, the questions of discipline, fines, suspensios, expulsions, finance, overlapping of practice in branches, and all matters not coming within the provisions of sub-section (1) shall be dealt with by the council as a whole.

Registration Within One Year.

10.—(1) Any person residing in the Province of Ontario at the date of the passing of this Act, who has been engaged in engineering for five or more years, shall be entitled to be duly registered as a member of the association without examination, provided that such person shall produce to the council, within one year of the passing of this Act, satisfactory evidence of having been so engaged.

(2) Any person residing in the Province of Ontario, not qualified as in subsection (1) above, may make application for membership in the association and shall successfully pass such examination as shall be prescribed by council, or submit credentials satisfactory to the council, to be admitted to membership.

(3) Any person who applies for membership in the association within one year from the passing of this Act shall submit to the council with his application a statement giving a summary of his engineering experience which statement shall be made upon the forms prescribed by the council.

(4) The council may require the applicant for membership to prove the correctness of the statements made in his application by attesting by oath or by affidavit.

(5) If the evidence of employment as engineer for five years, as submitted by the applicant, be considered satisfactory by the members of the council representing the branch to which admission is desired, he shall be admitted to membership in the association without examination and the registrar shall issue a certificate of registration to applicant and enter his name in the register.

(6) Any person duly authorized and registered as an Ontario land surveyor at the date of the passing of this Act shall be entitled on application within one year of the passing of this Act, to be admitted as a member of the association in the branch of civil engineers.

11. If the applicant for membership has been engaged for less than five years as a professional engineer at the date of the passing of this Act, he shall submit certificates and proofs respecting the period of his employment to the date of his application, and the members of council, representing the branch to which permission is desired, will determine from the evidence so submitted the period of such employment.

Registration After One Year.

12. Any person resident in the Province of Ontario who has applied for membership in the association within one year from the passing of this Act, who has not been admitted under the provisions of section 10, shall file with the secretary a notice setting forth his employment and the name of his employer, which notice shall be filed annually during the term necessary to complete the five years of employment, and if such person's record of employment is satisfactory, he shall be admitted to membership without examination.

13.—(1) Any person who applies for membership in the association after one year from the passing of this Act shall submit to the council with his application a statement giving a summary of his experience as an engineer or surveyor which statement shall be made upon the forms prescribed by the council.

(2) The council may require the applicant for membership to prove the correctness of the statement made with his application by attesting by oath or by affidavit.

(3) If the evidence of engineering experience for not less than five years, as submitted by the applicant, is considered satisfactory by members of council representing the branch to which admission is desired, the applicant shall be admitted to membership after successfully passing the prescribed examination in the theory and practice of such branch of engineering or, in lieu of such examination, upon submission of evidence satisfactory to the members of council representing such branch and to the council as a whole.

(4) An applicant who is required to successfully pass an examination may select any one or more branches of engineering for his examination.

14. Any resident of Canada who may come to reside in the Province of Ontario and who at the time is a duly registered member of an association of professional engineers in any province of the Dominion of Canada similarly constituted to this association, may upon application made to council be admitted to membership upon producing a certificate of membership in such province.

15. Any person who comes to reside in Ontario who is a registered member of any association or institute in other parts of the British Empire or in the United States similarly constituted to this association, and which grants reciprocal privileges and who applies for membership in this association, may be admitted to membership upon producing to council a certificate of membership in such association or institute.

Graduates.

16.—(1) Any graduate in any branch of engineering or of science, the practice of which constitutes professional engineering as defined in clause (g) of section 2, from any university recognized by the council upon presenting evidence of graduation satisfactory to the council will be granted, as part of his term of employment, the actual time of instruction in such university, this total not to exceed four years and such graduate will not be required to submit to a written examination.

(2) Graduates or undergraduates of recognized engineering colleges or bona fide assistants serving under articles may during the remainder of their respective periods required for registration be engaged in professional engineering as defined in this Act under the guidance of professional engineers who assume full responsibility for their work, but shall not be classed as professional engineers until registered as members of the association as provided in this Act.

(3) Such graduates, undergraduates, or assistants serving under articles may, during their respective engineering courses or terms of service, be recorded with the association, and such graduates, undergraduates, or assistants serving under articles shall be subjected to the control of the council as provided in this Act and to the by-laws of the association, but shall not be members of the association.

Licensing.

17.—(1) Any person not residing in the Province of Ontario who is a registered member of an association of engineers similarly constituted of any other province of the Dominion of Canada may upon application obtain from the registrar a license to practise as a professional engineer in the Province of Ontario upon production of evidence of his registry in such other province.

(2) Any person who is not a resident of Canada, but who in the opinion of the members of council in any branch is recognized as a consulting specialist in such branch of engineering, and has had not less than ten years of experience in the practice of his profession, or who presents evidence to satisfy such members of council that he has equal qualifications with those required for registration in such branch of the profession, may, with the approval of the members of council of such branch, be granted a license to practise in that branch.

(3) Any professional engineer who is a resident of some other province of Canada in which there is no association of engineers similarly constituted may obtain a license to practise in a branch of engineering, subject to the approval of the members of council representing such branch.

(4) In the event of any such person mentioned in this section being unable by reason of emergency or neglect on the part of the registrar, or for any other good and sufficient reason, to obtain such license within three months of his making application therefor, he shall be entitled to practise as a professional engineer in the province for such period of three months without holding such license.

18. Any person who is employed as a professional engineer by a public service corporation, public utilities or Government department, who is by reason of his employment required to practise as a professional engineer in provinces other than that of his residence, may so practise in the Province of Ontario without holding a non-resident license or payment of fee, providing such person can on demand of the council produce credentials satisfactory to the council showing that he is a registered member of an association of engineers similarly constituted by some other province of Canada.

Membership

19.—(1) Only such persons who are members of the association hereby incorporated, and registered as such under the provisions of this Act, or who have received a license from the council of the association as hereafter provided, shall be entitled within the Province of Ontario to take and use the title "Registered Professional Engineer," or any abbreviation thereof.

(2) Each member of the association shall have a seal, the impression of which shall contain the name of the engineer and the words "Registered Professional Engineer" and "Province of Ontario", with which seal he shall stamp all official documents and plans, and the design of such seal shall be approved by the council.

20. The provisions of this Act shall not apply against any person while carrying on his duties in His Majesty's naval, military or aerial service.

21. Engineers who were employed in professional engineering in the Province of Ontario, and who were accepted for overseas service in the war of 1914-1919, in the forces of Great Britain or any of her allies, shall on their return to Canada be entitled to all the rights and privileges conferred under section 10.

22. Notwithstanding any other provision of this Act, no person shall be registered as a member of the association until after he has attained the age of twenty-one years.

Partnership.

23.—(1) In the cases of two or more persons carrying on a practice as professional engineers in co-partnership, only such members who are registered or licensed under this Act shall individually assume the function of a professional engineer.

(2) A firm or corporation of professional engineers cannot, as such, be deemed to be a member of the association or be licensed to practise.

Examinations.

24. The council shall appoint annually a board of examiners for each branch of engineering from nominations made by members of council representing each of such branches.

25.—(1) Examinations of candidates for registration or for license shall be held at least once per annum, at such place or places as the council may direct.

(2) The scope of the examinations and the methods of procedure shall be prescribed for each branch by the members of council representing such branch, with special reference to the applicant's ability to design and supervise engineering works which shall insure the safety of life and property.

(3) The board shall examine all degrees, diplomas, certificates and other credentials presented or given in evidence for the purpose of obtaining registration or license to practise, if referred to them by the council, and may require the holder of such degree, diploma, certificate or other credentials to attest on oath, viva voce or by affidavit concerning the matter of his application.

(4) The candidate shall submit to an examination before the board, or before such members of the board as may be deputed by the council to conduct such examination, on such branch or branches of professional engineering as the candidate may select.

(5) As soon as possible after the close of each examination the members of the board who shall have conducted such examination shall make and file with the secretary a certificate stating the result of such examinations, whereupon the council shall notify each candidate of the result of his examination and of their decision upon his application.

(6) A candidate failing on examination may after an interval of not less than nine months be examined again.

(7) The council shall from time to time prescribe the fees payable by candidates for examination, which fees shall be payable in advance by the candidates.

26. The council shall have power to establish conjointly with any council of any association similarly constituted in one or more of the provinces of Canada a central examining board, and to delegate to such central examining board all or any of the powers possessed by the said council respecting the examinations of candidates for admission to practise, provided that any examination conducted by such central examining board shall be held at least in one place within this province.

Register and Registrar.

27.—(1) The registrar shall issue a certificate of membership to each member admitted to the association by the council, such certificate to be signed by the president or the vice-president and by the registrar, and it shall bear the seal of the association, and shall also state the branch or branches of engineering in which the member was examined or otherwise accepted.

(2) The registrar shall issue a license to practise to any person entitled thereto, such license to specify the work upon which the holder of the license is to be employed and the period for which the same is issued, but in no case shall the period extend beyond the end of the calendar year in which such license was issued.

(3) The registrar shall enroll in the register provided by the council the names of all persons admitted to the association by the council also the names of all persons licensed by the council.

28. The registrar shall keep the register correct and in accordance with the provisions of this Act and the instructions of the council.

29. The annual fee due from a member shall be deemed to be a debt due the association and may be recoverable with the costs of same from such member in the name of the council or of the accociation in any court of competent jurisdiction.

30.—(1) If any member neglects or refuses to pay the annual fee for six months from the date upon which it became due after written notice from the secretary to the member's last known address on the register, the registrar shall cause the name of such member to be erased from the register, and such person shall thereupon cease to be a member, but such person shall at any time thereafter, upon payment of such fees as may be prescribed by the council, be entitled ro reinstatement as a member.

(2) Any member may resign from membership in the association upon giving written notice to the secretary and by payment of all dues in arrears, if any, whereupon the name of such member shall be erased from the register and such member shall be relieved of the liability for further annual dues, but such person shall at any time in the future be admitted as a member upon payment of the fees prescribed by the council.

(3) Any member whose name has been erased from the register shall not be entitled to any of the rights and privileges conferred by the provisions of this Act until he has been re-admitted as a member.

31. In case the council should refuse to register any applicant for membership in the association, or refuse to issue a license to practise to any applicant therefor, the person aggrieved shall have the right to apply to a judge of the Supreme Court of Ontario, who upon due cause shown may make an order directing the council to register the name of such person as a member of the association, or to grant a license to practise, or make such other order as may be warranted by the facts, and the council shall forthwith comply with such order and such order when so made shall be final.

32. The certificate of registration under the seal of the association shall be **prima facie** evidence of registration.

Suspension or Expulsion.

33.—(1) The council may, in its discretion, reprimand or censure or suspend or expel any member guilty of unprofessional conduct, or of gross negligence or of continued breach of the by-kaws of the association, or any member convicted of a serious criminal offence by a court of competent jurisdiction.

(2) The council shall not take any such action until after a complaint under oath has been filed with the secretary or the registrar, and a copy forwarded to the member accused, who shall be given an opportunity of submitting evidence in his defence, and the council shall not suspend nor expel a member without having previously summoned him to appear before the council, nor without having heard evidence under oath offered in support of the complaint and in behalf of the member accused.

(3) The council shall have the same powers as Commissioners under **The Public Enquiries Act** to compel witnesses to appear and give evidence under oath in the manner and under penalties prescribed by such court, and all such evidence shall be taken in writing or by a duly qualified stenographer.

(4) Any member suspended or expelled may within sixty days after the order of suspension or expulsion appeal to a judge of the Supreme Court of Ontario from such order or resolution, giving not less than seven days' notice of such appeal to the secretary of the association, and the practice and procedure in such an appeal shall be the same as upon an appeal from a master or referee.

(5) Pending an appeal, the member suspended or expelled by council may continue to practise, but unless the order of suspension or of expulsion be set aside, the member so suspended or expelled shall not practise thereafter except upon the expiry of the period of suspension (in case of suspension).

Penalties

34. Any person in the Province of Ontario who, not being registered as a member of the Association in the Province of Ontario, or licensed by the association.

(a) Uses verbally or otherwise the title of professional engineer, or makes use of any addition to or abbreviation of such title, or of any words, name or designation that will lead to the belief that he is a professional engineer or a member of the Association;

(b) Advertises or holds himself out in any way or by any means as a member of the Association;

shall be liable upon summary conviction by any court of competent jurisdiction to a fine of not less than $100 nor more than $200 for the first offence, and to a fine of not less than $200 nor more than $500 for any subsequent offence.

35. If the registrar makes or causes to be made wilful falsification of the register, or in matters connected therewith, he shall upon conviction be liable to a fine of not less than $100.

36. Any person who wilfully procures or attempts to procure for himself registration as member in the association by making, producing or causing to be made or produced any fraudulent representation or declaration, either verbal or written, and any person knowingly aiding and assisting him therein, shall upon conviction be liable to a fine of not less than $200.

37. Any and all penalties imposed under this Act, and any and all moneys forfeited shall be recoverable with costs under the provisions of **The Ontario Summary Convictions Act**, and all such sums shall belong to the association.

38. No proceedings shall be commenced for any violation against the provisions of this Act after one year from the date of the committal of such violation.

Provisional Council

39.—(1) The following persons are hereby constituted as a provisional council of the association:—

President— Charles Hamilton Mitchell, of Toronto. Vice-President—Robert Alexander Bryce, of Toronto. Councillors—Representing branch of Civil Engineers—Willis Chipman, of Toronto; John Bow Challies, of Ottawa; Andrew Wellington Gray, of Westport.

Representing branch of Mechanical Engineers—Henry G. Acres, of Toronto; Harry Holborn Angus, of Toronto; Arthur Knowlton Spotton, of Galt.

Representing branch of Chemical Engineers—James Watson Bain, of Toronto; Stafford Frederick Kirkpatrick, of Ottawa; Harold Van der Linde, of Toronto.

Representing branch of Electrical Engineers—Henry U. Hart, of Hamilton; Frank Richard Ewart, of Toronto; Morris James McHenry, of Walkerville.

Representing branch of Mining Engineers—George Reginald Mickle, of Toronto; H. E. T. Haultain, of Toronto; James McEvoy, of Toronto;

all of whom shall hold office until their successors have been elected and appointed.

(2) If a vacancy should occur in the Provisional Council it shall be filled by the Lieutenant-Governor in Council, who shall notify each member of the Provisional Council of such appointment.

40.—(1) The Provisional Council shall provide the register called for by this Act, and shall cause to be entered therein the names of all persons who are entitled to registration and who apply therefor.

(2) The Provisional Council shall, within four months from the passing of this Act, prepare provisional by-laws not inconsistent with the Act for the various purposes specified in section 4 of this Act, which shall not be valid until approved by the Lieutenant-Governor in Council.

(3) The Provisional Council shall publish a copy of the register within five months from the passage of this act, and shall mail one copy of such register to each member, and to any person who may apply for a copy, and the Lieutenant- Governor in Council shall also be furnished with a certified copy of the register and of the provisional by-laws.

(4) The Provisional Council shall call a general meeting of the members of the association for the purpose of electing the members of council, for confirmation or revision of by-laws, and for organization purposes, and for such other purposes as specified in the notice calling the meeting, such general meetings to be held not later than seven months, nor earlier than five months after this Act comes into force.

41. No provisions of this Act imposing penalties shall take effect until one year after the coming into force of this Act.

42. This Act shall come into force and take effect on the day upon which it receives the Royal Assent.

CORRESPONDENCE

The Transmission of Energy by the Water Molecule. Its Relation to Basic Production.

Storage of the Sun's Energy. The results of Research in Molecular Physics.

Toronto, June 6th, 1922

Editor, *Journal:*—

Dear Sir:—

It was suggested to the writer that something further might be contributed to the questions so interesting discussed by Professor R. W. Boyle in his paper on "Rainmaking" in the May number of *The Engineering Journal.* Professor Boyle need not offer any apology for introducing "the physics of a very common and ordinary phenomenon" but the writer will go further by saying that some phenomena are so common and ordinary as to have hitherto escaped any critical examination at all. This is especially true of some phenomena to which the writer wishes to call attention in the hope of closing one of the wide gaps that still exist in our knowledge of the world about us.

One of the key problems introduced by Professor Boyle is that of the latent heat of condensation. We know the exact amount of this heat energy; we know that it disappears when water is turned into steam, that it reappears in exactly the same amount when steam is condensed into water, and that the temperature remains constant at 100°C during these changes. But we do not know the form or the exact location of this energy while it is hidden or "latent" in the steam. The solution of this question would very probably throw light on some others of great practical importance such as those related to the production of the vast fields and forests of Canada.

To fix our ideas, let us think of a cubic centimetre of water. Its mass is one gram. When it is turned into steam at air pressure it occupies 1,700 cu. cm. In that form it consists of thirty-four thousand billion billion molecules separated from one another. Each is a tense, hard, but elastic sphere having a diameter of 0.0000000385

cm. and the mean distance between them is about twelve times this diameter. Each has its own random velocity which is uninfluenced by the others except when the molecules happen to come into contact with each other and with the sides of the containing vessel. We know that these molecules in this separated condition contain somehow or other 498 calories of heat energy which they did not contain when as water they occupied only one cubic centimetre at the same temperature. So long as the molecules are in this separated condition this large quantity of energy cannot by any known means be detected, although its amount is sufficient to raise the temperature of five times the quantity of water from the freezing to the boiling point.

Many attempts have been made to trace this energy to its source. The fact that the steam engine is able to do work only after this enormous amount of latent heat energy has first been expended shows how important is the question. Unless this energy is recovered as heat which can be used at temperatures below 100° C it is a total loss economically. But steam engines and steam heating plants still continue to distribute heat by mysteriously hiding it away on its journey. Various speculations, or hypotheses as they are called, regarding the nature of this energy have been put forward but all to little purpose. One of these hypotheses is that of molecular attraction, by which two molecules when close together are thought of as pulling each toward the other just as the earth and the moon attract each other by gravitation but with a much stronger force. This force, however, ceases to pull at all when the molecules are more than two or three diameters apart. In steam, therefore, the molecules are too far apart for them to attract each other except when they are near collisions. Another and more modern hypothesis conceives of two molecules as both pulling and pushing each other simultaneously with two forces which depend by different laws on the distance the molecules are apart. Now while these two hypotheses may tell us the way in which two molecules may be held together in water, they do not tell us how the molecules of steam hold the latent heat energy. It was thought also that they showed how the surfaces of all liquids are endowed with that tension which we know pulls against itself at all points and in all directions in that surface, but these explanations are not now seriously entertained although they are in all text books which deal with surface tension.

The writer proposes to show how these two problems concerning the latent heat of steam and the nature of surface tension were both solved by a single method which disclosed as well how the sun's energy is held in the atmosphere and transmitted to the different parts of the earth's surface.

As in the surface of water in a vessel so in the surface of a rain drop there is this tension or force pulling against itself to lessen the extent of that surface. On each side of a line 1 cm. long it pulls with a force of 73.3 dynes. (1,000,000 dynes is the air pressure on a square centimetre.) In consequence of this tension each square centimetre of water possesses 73.3 ergs of potential surface energy (P.S.E.); (41,840,000, or J, ergs is one calorie, which is the energy required to raise one gram of water through 1° C.). Now, since long before the first shower wet the skins of primative man, water drops have coalesced whenever they came into contact, and large ones have broken into smaller ones whenever the sea dashed itself against the rocks. Suppose, then, that three rain drops 0.3, 0.4, and 0.5 cm. in diameter come into contact and coalesce. The resulting sphere will have a diameter of 0.6 cm. By this act the total surface has been reduced by 0.44 sq. cm. Consequently, the P.S.E. has been reduced by 0.44x73.3 or 32.3 ergs. This energy is now in the form of heat and the water will be so much warmer, (0.000068° C). If the temperature remains constant, the heat will be available for other purposes. On the other hand it will require exactly this amount of energy to break up the large sphere into the three smaller ones again, and the energy will then be properly called the latent heat of the three spheres. This simple piece of reasoning suggests that latent heat is simply surface energy which has to be supplied whenever the free surface enveloping mass is increased and which reappears whenever that surface is decreased in extent.

The writer published the general case of the reasoning above in the Philosophical Magazine in June 1921, pp. 878-889, and it may be well to give here a brief outline of its main features.

The amount of P.S.E. changed into heat when N drops of water each having a diameter of d cm. coalesce into one mass is proved to be

$$T\left(\frac{36\,\bar{\pi}\,m^2}{\rho^2}\right)^{1/3} N^{1/3} \text{ ergs,}$$

where $\bar{\pi}$ is the molecular weight of the substance, ρ its density, and T its surface tension. If L is the latent heat in calories of one gram mass of the substance, the total latent heat of m grams is mLJ ergs. When these two amounts of energy are put equal and the resulting equation solved, we obtain

$$N = \left(\frac{(LJ)}{T}\right)^3 \frac{m\rho^2}{\bar{\pi}}$$

Now it has been proved experimentally that the surface tension of a liquid increases by the same amount for each degree that the temperature is lowered. It will, therefore, have its maximum value at — 273°C even though the liquid has become a solid. The reason that surface tension increases with lowering temperature is that the molecules in the liquid lose in velocity as the temperature goes down. At — 273°C the molecules are at rest and the tension is that of the molecule itself. For water the molecular tension is 133.6 dynes, per cm. Also after allowing for the work of pushing the air back to make room for the steam there remains 498 calories of energy which is the true latent heat of a gram mass of steam. Moreover, the molecules of water at 4°C may be supposed to fill up all the space so that the molecular density may be taken equal to 1. When these values are substituted in the above equation we obtain, N $N = 6.05 \times 10^{23}$. This is the exact number of molecules which is known to be in 18 grams of water. It is the same

for *m* grams of any substance and is known as Avogadro's number. While the existence of this number was discovered more than a century ago its actual value has only recently been determined. By using a method totally different from the one described above Millikan obtained the value 6.065 x 10^{23}; Perrin likewise by another method obtained a somewhat larger value. Now the writer also found that in the case of nine other liquids the method of coalescence gave results of the same order of magnitude as water. It is difficult then to escape the conviction that the law of coalescence which never fails to act for all visible liquid spheres is effective down to the last two molecules.

From this there seems to be no alternative but to regard the latent heat of steam as the potential surface energy of the free molecules of which the steam is composed. Few laws in the physical world rest upon so solid a foundation. It necessarily follows (1) that free molecules possess surface tension which is somewhat greater than that of the liquid into which they condense, (2) that each free molecule carries a definite amount of potential surface energy equal to mLJ/N ergs which it cannot give up so long as it does not touch another, and (3) that when they suffer an impact they do not rebound like rubber balls but attach themselves to each other by means of their surface forces which on account of their relative velocity being too great allows them to separate again with their total kinetic energy unchanged.

This law may be further illustrated. In 18 grams of liquid water which is composed of six hundred thousand billion billion molecules there is only 33 sq. cm. of exterior surface. To convert it into steam will require 8,978 calories of energy. The separated molecules will then have a total surface area of 69.7 acres and will be loaded with precisely 8,978 calories of P.S.E. Now, we may suppose that when these molecules coalesce they go; first, all into groups of two; secondly, the groups of two into groups of four; thirdly, the groups of four into groups of eight; and so on. Then this process of pairing would occur 79 times, (not more), before the steam would become a single mass of water. The changes in surface area and in P.S.E. are given in the table below.

Order of pairing.	Reduction of Surface in acres.	P.S.E. changed to heat, in calories.
1	14.5	1847
2	11.5	1466
3	9.11	1163
4	7.23	934
5	5.76	733
6	4.56	582
7	3.62	462
8	2.88	366
9	2.28	291
10	1.81	277
Total for first 10 orders	63.24	8071
Bal. for rem. 69 orders	6.50	907
Total for complete cond'n	69.7	8978

Again to use Professor Boyle's illustration, the heat produced in 1000 cub. ft. of air containing 120,000,000 fog particles, which condense into 1/150 ounce of water amounts to 9,500 ergs; but the heat produced in forming the fog particles from the molecules amounts to nearly 3,930,000,000 ergs, or 48 calories.

It is the writer's desire to discuss the distribution of this energy in the August issue of *The Journal*, if space permits.

Sincerely yours,

WILSON TAYLOR, B.A., Associate E.I.C.

* * *

The Art of Rapid Computation and Science of Numbers

J. W. Harris, C.E., M.E.I.C., has prepared a small book in which are collated, in the most comprehensive manner, many useful rules of mathematics, embodying time saving devices which should be of great value in every office in which rapid calculation is a factor of efficiency. Mr. Harris, who has been for many years Assessment Commissioner of Winnipeg, has combined in this book not only the easy solution of the mathematical problems with which his assessment work brought him constantly in contact, but also problems encountered in almost every phase of modern business. The text is divided into four sections; first, "General Text", in which the fundamental principals of the subject are reviewed and each step of the familiar text books on arithmetic is explained with definitions, examples, and rules for eliminating much of the usual tedious work; second, "Commercial Section", in which all phases of financial mathematics are treated; third, "Technical Section", in which are given tables of the various systems of measurement together with essential data required in every branch of engineering; fourth, "Miscellaneous Section", in which, as the title implies, the author has compiled a large and varied assortment of problems extending over a wide range of subjects.

* * *

Research Develops New Use for Canadian Wood

Many people when passing a shop where automobile storage batteries are sold must have noticed in the window one or two batteries cut open to show the interior construction. These sections show the edges of the lead plates used in the battery and between the plates very thin corrugated sheets of wood. These sheets are known as separators and while perhaps appearing relatively unimportant have in fact been the subject of extensive research.

Wood for battery separators must possess special chemical and physical properties and until very recently the wooden separators used in Canada were made almost exclusively of imported woods. The Forest Products Laboratories of the Forestry Branch, Department of the Interior, recently undertook research to determine whether any Canadian wood was suitable for separator work, and as a result found a most excellent material in the yellow cypress of British Columbia. This wood was found to possess the requisite properties to a high degree and is now in regular commercial use for the manufacture of separators.

Preliminary Notice

of Applications for Admission and for Transfer

19th June, 1922

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in July, 1922.

FRASER S. KEITH, Secretary.

*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option, Railway, Municipal Hydraulic, Mechanical, Mining or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects, Geography, History (that of Canada in particular), Arithmetic, Geometry, Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits scientific acquirements or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge

The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

ALLEN—HAROLD A., of St. John, N.B. Born at Millville, N.B., Aug. 7th, 1889; Educ., I.C.S.; 1916, foreman bldg., constrn., licensed by the city of Boston bldg., dept., 1917 designed and constructed the ways for side launching Marine Constrn. Co., St. John; 1918, plant constrn., Imperial Oil, St. John; 1919, Engineers and Contractors, Ltd., St. John; 1920, J. A. Grant & Co., St. John; 1921, Lock Joint Pipe Co., St. John; at present designing and contracting, Allen & McCaw, St. John, N.B.

References: J. A. Grant, E. M. Archibald, G. G. Hare, W. D. Robertson, C. C. Kirby, W. G. Chase.

BAILEY—HAROLD MILTON, of Melfort, Sask. Born at St. Mary's, Ont., Jan. 20th, 1889. Educ., I. C. S.; previous to 1906, lineman, troubleman, combn. man, and as asst. in Power Plant; 1906, recd'. Steam Engineer's cert. for Prov. of Ont.; 1906-10, supt. of constrn. and asst. mgr., St. Mary's Kirkton Telephone Co., and supt. of constrn., for Stromberg, Carlson Telephone Co., in Huron County; 1910, mgr. Tuckersmith Telephone Co., Seaforth, Ont.; 1911, contracting in Sask., built Davis Telephone System; 1912-13, Sask. Govt. Telephones, in chg. of constrn., Prince Albert-Tisdale L. D. Line; 1913-14, supt. electr'cl. dept., Town of Melfort, having chg. of Municipal Telephone System and electric light plant including all constrn; 1914-19, overseas with R.C.E., as Capt. on command to Cdn. Corps Signals, constr'ng., advanced underground cable system, Cdn. Corps Tramways in chg. of constrn. and operation no. 2 section, 172 Tunnelling Co., R.E., tunnelling and mining at Vimy, chg. of constrn. of Vimy fortifications and with 4th Army Troop Co., constructing hydraulic water supply, N. Flanders; 1919-21, supt. of electr. dept., Town of Melfort, took over chg. of all municipal works as Supt. of Public Works and Utilities, including chg. of all local improvements and utilities, and new constrn. in connection therewith; at present supt. Public Works and Utilities, Town of Melfort.

References: J. R. L. Parsons, A. A. Murphy, J. E. Underwood, R. A. Garvie, J. Johnson, G. D. Archibald.

BANNANTYNE—NINIAN, of Halifax, N.S. Born at New Romney, Kent., England, 5th Dec., 1889. Educ., Pocklington Grammar School, E. Yorks, England; 1908-10, app'tce., Clover, Clayton & Co., engrs. and ship repairers, Birkenhead; 1910-13, Cammell, Laird & Co., Birkenhead, for nine months junior dftsman; attended tech. school during this time; 1913 (3 months), junr. engr., S.S. "Malalsand" (4000 I.H.P.); 1914 (Jan.-Aug.) dftsman., in master mechanic's office, Northern Elec. Cable Wks., Montreal; 1914-15, Sub. Lieut. and watchkeeper, H.M.C.S. "Niobi"; 1915-17, Engr. Lieut. and ch. engr., in chg. of machinery, H.M.C.S., "Rainbow"; 1917-19, in chg. of all repairs to hulls, boilers and machinery of all patrol vessels based at Sydney, N.S. (approx. 76 vessels, comprising drifters, trawlers and other larger vessels); 1919-20, engr. Lieut., H.M.S. "Resolution"; 1920, senior engr., H.M.C.S., "Aurora" (30,000 S.H.P.) and at present.

References: J. F. Bell, T. C. Phillips, G. L. Stephens, R. H. Wood, F. P. Jennings, N. K. Hay, T. J. Brown.

FAHEY—JAMES VINCENT, of 62 Albert Str., E., Sault Ste. Marie, Ont. Born at Elgin, Ont., Feb. 24th, 1894. Educ., B.Sc., Queen's Univ., 1921; 1912, chainman Can. Nthrn. Rly., survey, during summer; 1916 (summer) rodman, Canadian Govt. Geological Survey; 1919-20, water regulation and storage survey; 1921 (May-Nov.) hydraulic dept., résident on construction of 33,000 volt line, Spanish River Pulp and Paper Mills, Ltd.; at present, hydrometric survey, hydraulic dept., Spanish River Pulp and Paper Mills, Ltd., Sault Ste. Marie, Ont.

References: G. H. Kohl, J. L. Lang, K. G. Ross, F. T. Gnaedinger, W. H. B. Bevan, L. M. Arkley, L. T. Rutledge.

HILL—PERCY PRIDMORE, of Lachine, Que. Born at Sharnford, Leicestershire, England, Sept. 8th, 1891; Educ., Leamington Spa Tech. Sch., and one term "Myton College", Warwick, Eng.; appt'ced., British Thomson Houston Co., Rugby 1908-11, practical experience with Brush Electrical Co., Loughborough, and General Electric Co., Birmingham, etc., till 1912; 1912-14, production engr., chg. automatic, mech., and tool layouts, C. A. Vandervell & Co., London, Eng.; 1914-15, product. engr., chg. tool design and layouts, Berliner Gramaphone Co., Hayes, Middlesex; 1915-16, tool room foreman, and from June-Dec. 1916, asst. ch. inspectr., Vickers, Ltd., Birmingham; 1916-17, Royal Air Force; 1917-18, transferred to aero inspectn. dept., British Govt., at Lanchester Motors, Ltd., Birmingham, in chg. Sunbeam Coatalen (Hispano Suiza) aero engine constrn.; 1918-19, ch. insptr., Rudge Whitworth Ball Race Wks., Birmingham; 1919, manufacturing own patents automobile accessories under name of "Easting" Windscreen Co., co-partner in this concern until emigration to Canada 1920; exhibited further patents at Montreal Automobile Show, Jan. 1921, under name, Hill, Johnson & Co., Lachine, being inventor and patentee; at present dftsman., engr'g. dept., Montreal Public Service Corpn., Montreal.

References: K. B. Thornton, J. A. Duchastel, L. H. Marrotte, P. Ackerman, S. Svenningson, N. L. Engel, J. A. McCrory.

HOWARD—RUPERT FORTESCUE, of Lachine, Que. Born at Lachine, Mar. 16th, 1878; Educ., B.Sc., McGill Univ., '01; 1897-1900 (summers) in shops and completed student's course with Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.; 1904-07, constrn. dept., of same company; 1907-17, transferred to Canadian Westinghouse Co., Montreal, as dist. engr., with chg. all engr'g. work in Montreal district (Ottawa to Eastern Sea-board), chg. of company's work at City of Winnipeg, Hydro Elec. Plant. Attached to Winnipeg office as commercial engr., 1917; 1917-21, ch. elec. engr., in chg. all design and install'n. of electr. equip'mt., at mines and smelter Sudbury, Ont., and equip'mt., at the refinery, Ottawa, and after install'n., had chg. of operation of equip'mt.; 1922, asst. in proposed steam road electrification report for Temiskaming and Nthrn. Ontario Rly., with Kerry & Chase, Ltd., consltg. engrs. Toronto; at present private consulting work, 416 Phillips Pl., Montreal.

References: J. G. G. Kerry, J. Murphy, A. A. Bowman, H. U. Hart, J. A. Hesketh.

IRVINE—FREDERICK, of Montreal, Que. Born at Liverpool, England, Dec. 14th, 1887; Educ., Liverpool Coll; 1900-06, app'tceship., design, constrn., and mtce., land and marine boiler and engines, pumping machinery, turbines, elec. and mech. power transmission, hydraulic and refrigerating machinery, internal combsn. engines, plant lay-out, dftsman, concrete constrn., diving and dredging operations, Thomas Summer and Sons, Liverpool; 2nd class British Board, of Trade cert; 1907, engr. in chg, of ship, British Merchant Service; 1908, eng'gd., on erection of locomotive engines at Angus shops, C. P. R., Montreal; 1909-11, exper'mtg. internal combsn. engines, Vulcan Engr'g. Co., Southport, England, 1911, asst. engr., on buildings, plant lay-out, employment and organization native labour, Russian and German spoken, Riga, Russia; 15 mos. later app'ted., ch. engr., Kourgan, Siberia; 1913, supt. engr., 40″ steel

clear water pipe across Ottawa Corpn. Water Works; 1914-20, Engr. Lieut., R. N. R., H. M. S. "Olympic", Ottawa River 1921 to date, combustion engr., Cleaton Co. (Canada) Ltd., Montreal.

Reference: J. T. Farmer, W. G. Scott, F. I. C. Goodman, C. W. Burroughs, H. Wright, A. H. Ross, R. Beausoleil.

MURPHY—ALEXANDER GORDON SILCOX, of 620, Victoria Ave., Westmount, Que. Born at Montreal, Que., Sept. 12th, 1899; Educ., B.Sc., McGill Univ., 1922; 1917, (May-Nov.), Inspctr., Board of Engrs., Quebec Bridge; 1920 (May-Aug.), Inspector, Grand Trunk Arbitration Board.

References: C. N. Monsarrat, H. M. Mackay, J. Rankin, C. McKergow, E. Brown.

RICHMOND—JOHN, of 77 St. Matthew St. Montreal, Que. Born at Smiths Falls, Ont., Mar. 8th, 1892. Educ., B.A.Sc., Univ. of Toronto, '16; 1914, constrn. wk., Cedar Rapids Power Co., and Mt. Royal Tunnel; 3½ yrs., inspctr. of wire and cable, 2½ yrs., meter repair, test set design and constrn., general tests and repair of switchboard apparatus, and at present, chief of inspection, laboratory dept., Northern Electric Co. Ltd., Montreal.

References: J. D. Hathaway, N. L. Morgan, F. S. Keith, W. H. Eastlake, J. S. Cameron, T. E. Wilmot, W. C. Adams, W. Tyler.

TAYLOR—ROBERT EVERSON, of Winnipeg, Man. Born at South Shields, England, Apr. 14th, 1890; Educ., South Shields Marine School (tech. dept.), and Sunderland Tech. Coll., England; 1906-11, app'tce., North Eastern Rly., England; 1911-12, rodman, topog'r., instr'man., Grand Trunk Pac. Rly.; 1913-14, dftsman., chief engr's., office, Hudson Bay Rly.; 1914-17, instr'man., and acting res. engr., Hudson Bay Rly.; 1918-19, o'seas, Canadian Engrs.; 1919 to date, design'g., engr., for coal handling equipm't., railroad track scales and reinforced concrete structures, Canadian Nat. Rlys., Western Lines, Architect's dept., 453, Union Depot, Winnipeg, Man.

References: H. A. Dixon, J. W. Porter, J. V. Dillabough, F. P. Moffat, T. C. Main G. F. Horsey, E. N. Johnson.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

BEATTY—JAMES A., of Bayview Ave., Toronto, Ont. Born at Fergus, Ont., May 8th, 1879. Educ., grad. S.P.S., Univ. of Toronto, 1903; 1904, steel constrn., Riter-Conley, Pittsburgh, Pa.; 1905-06, genrl. engr'g., Ross & Holgate, Montreal; 1907, supervising genrl. constrn., Dominion Engineering and Constrn. Co., Montreal; 1908, began contracting Morrow & Beatty, Ltd., and completed the following structures:— Kipawa Dam, Gordon Creek and Quinze Dams for Dom. Govt., Hydro Plant, City of Sherbrooke, Que., 3,000 h.p. Wawiatin Power, Porcupine Distr., 6,000 h.p., Abitibi Power and Paper Plant consisting of 25,000 h.p. Hydro Power., 200-ton Ground Wood Mill and 250-ton News Print, the Mattagami Pulp and Paper Plant. Smooth Rock Falls, Ont., 10,000 h.p., and 150 tons Sulphite, Hydro Plant for Southern Canada Power, Drummondville, Que., 12,000 h.p. 13,500 h.p. Hydro Plant for Bathurst Lumber Co., 30,000 h.p. Hydro Plant., Twin Falls, Abitibi Power and Paper Co.; at present with Morrow & Beatty. Ltd., Peterborough, Ont.

References: H. A. Morrow, W. J. Francis, H. G. Acres, Wm. Kennedy, Jr., R. A. Ross.

EDWARDS—HAROLD, of 301, Somerset Bldg., Winnipeg, Man. Born at Hemmingford, Que., Nov. 25, 1874; Educ., A. B. Harvard Univ.; 1896; 1899-02, General Electric Co., Schnectady, N.Y.; 1902-03, Montreal, L. H. & P. Co.; 1903-07, electric rly., work around Boston, Mass.; 1910-22, consltg. engr., genr'l. consltg. wk., particularly on fireproof bldg. constrn., Power stations (Winnipeg Elec. Rly., and Winnipeg Genr'l. Hosp.), concrete chimneys, etc., (C.N.Rly. and C.P.Rly.), Winnipeg; at present, consltg. and constrn. wk., President, Harold Edwards, Ltd., Winnipeg, Man.

References: W. M. Scott, D. A. Ross, J. N. Finlayson, E. V. Caton, H. A. Dixon, W. P. Brereton, P. Burke-Gaffney.

McLEAN—WILLIAM BROWN, of 154, 44th Avenue, Lachine, Que. Born at Pictou, N.S., March 31st, 1876. Educ., B.Sc., McGill Univ., 1899; 1894-1900, Robb Engineering Works; 1901-05, engr., Union Bridge Iron Works, Manchester; 1905-07, pvte. practice, Montreal; 1907-08. J. A. Jamieson, Montreal; 1908-15, consltg. engr., Montreal; 1915-19, Vice-Pres., and Mng'g. Director, Munitions and Machinery Ltd.; 1919-22, Vice-Pres. and Mng'g. Director, Maple Leaf Manufacturing Co., Ltd., Montreal, to date.

References: J. A. Jamieson, H. M. Mackay, R. Bickerdike, Jr., R. A. Ross, Geo. McLeod.

PHILIPS—HECTOR SOMERVILLE, of Hamilton, Ont. Born at Airdrie, Scotland, Nov. 20th, 1882; Educ., Heriot Watt College, Edinburgh, Scotland; 1901-02, asst., J. M. Maclean, surveyor, Edinburgh; 1902-04, asst., Morham & Gardner, engrs. and surveyors, Edinburgh; 1904-07, contractor's asst. engr., Edinburgh and Dist. Water Works, Leith Imperial Dock; 1907-09, asst. A. & R. MacCulloch, M.I.C.E., Leith, Scotland; 1909-10, contractor's engr., Troon Water Works, Scotland; 1910-11, asst. engr., Fowler & Siggelkow, C.E., Mt. Kisco, N.Y.; 1911-12, dftsman., Main Drainage Dept., City of Toronto; 1912-13, res. engr., storm sewers, and 1913-16, engr. in chg. sewerage design, Dept. of Wks., Toronto; 1915 (July-Dec.), on loan from Dept. of Wks. Toronto, as asst. dist. engr., on staff of consultg., sanitary engr., to Internat. Joint Commission; 1916-17, design'g. engr., Canada Nitro Products, Ltd., Toronto; 1917-19, Lieut. Can. Engrs.; 1919-20, asst. D.V.O., Montreal Dept., Soldiers' Civil Re-establishment; 1920-21, engr. in chg. sewer design, City of London, Ont.; 1921 to date, engr. in chg., sewerage design City of Hamilton, City Engineer's Dept., Hamilton, Ont.

References: E. R. Gray, H. A. Brazier, G. G. Powell, I. H. Nevitt, C. H. Rust, W. P. Near, R. R. Knight.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

AULD—ROBERT WHYTE, of 1315, 13th Ave., Calgary, Alta. Born at Strichen, Aberdeenshire, Scotland, 1st Nov. 1887. Educ., Sharp's Institution 1892-06, and Alberta University 1919-20; app'tce., Condie, Mackenzie & Co., C.E., Perth, Scotland; 1905-07, asst., to this firm under Alex. Buttar their C.E., artificial lakes, drainage roads, water supplies including Auchterarder Fish Pond; 1907, asst., Melloy & Sons, D.L.S., C.E., and contractors, Winnipeg, Man.; 1908, asst. C. M. Teasdale, D.L.S., Moose Jaw; 1909-13, asst. John Waldron, C.E., D.L.S., Moose Jaw; 1914-16, sapper R.E., 1917-19, Lieut., R.G.A.; 1920, asst. plane table party and 1921, asst. reconnaissance party, Dominion Government; at present asst., location party (Dom. Govt.) N. Saskatchewan project.

References: V. M. Meek, M. H. Marshall, B. Russell, Jr., R. S. B. Lillico, S. H. Hawkins, I. R. Strome.

EMREY—JOSEPH DESMOND, of 78 Lacroix Str., Chatham, Ont. Born at Nevis, B.W.I., Oct. 19th, 1890. Educ., B.Sc., Queen's Univ., '22. 1911 (5 months) chainman, rodman and levelman, railroad location and constrn., St. Kitts Nevis Sugar Factory, Ltd., B.W.I., and 3 months, foreman in charge reinforced concrete constrn.; 1912, rodman, railroad constrn., Toronto Eastern Rly., Oshawa for 5 mos. and transitman for 3 mos.; 1913 (9 mos.) transitman, radial and power line location, Hydro Electric Power Comm.; 1914 (summer), drafting and surveying, Sutcliffe & Neelands, New Liskeard, Ont.; 1914-19, 2nd and 3rd Can. Divn. Engrs.; 1919 (summer) Mucking, Sampling Hollinger Gold Mine, Timmins, Ont.; 1920 (summer), asst. engr., grading valuation, Montreal to Toronto, Grand Trunk Arbitration, Dept. Rlys. and Canals; 1921 (summer), foreman in chg., reinforced concrete James A. Vance, Woodstock; 1922 to date, field supt., Bridge Dept., Canadian Des Moines Steel Coy., Ltd., Chatham, Ont.

References: A. Macphail, W. P. Wilgar, L. M. Arkley, W. L. Malcolm, D. S. Ellis.

PARKER—IRVING HOLMAN of Montreal, Que. Born at New York City, U.S.A., June 9th, 1893. Educ., short period courses 2 yrs., Univ. of Michigan, genr. highway and engr'g; 1913-14-15 Cooper Union, N.Y., surveying and civil engr'g. courses; 1913-16, rodman, chainman, levelman and transitman on double deck elevated railroad work for Interborough Rapid Transit Co., New York City; 1917-19, Pilot H. S. Air Service, France and chg. of Prisoner of War detachment reconstr'g., shelled roads in France; 1919 (season) in chg. of paving City of Quebec, and 1920 (season) chief inspctr., in chg. of all paving inspctn., City of Montreal, under Milton Hersey Co. Ltd.; 1921 (season) supervised constrn. of all municipal paving, Montreal, chg. of work in Quebec and employed and trained inspectors for same; chg. of mixing and laying of pavement on Victoria Jubilee Bldg., chg. Longueuil Chambly Highway for Prov. of Quebec; at present supervising engr., Wm. I. Bishop, Ltd., and P. Lyall & Sons associated on Chambly Road contract.

References: H. B. Stuart, J. W. H. Ford, C. A. Mullen, W. C. Adams, W. I. Bishop, A. S. Going.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

DUNBAR—JOHN ROBERT of Hamilton, Ont. Born at Toronto, Ont., March 11th, 1900. Educ., B.Sc., (E.E.) McGill Univ., 1920; 1918-19-20 (summers), lightkeeper, recorder and asst. Geodetic Survey of Canada; 1920 to date, electr. engr., Canadian Westinghouse Co., Hamilton, as follows — Nov. 1920 to Sept. 1921, transformer design, Sept. 1921 to date, generator and motor design.

References: L. A. Herdt, C. V. Christie, E. G. Burr, N. J. Ogilvie, W. F. McLaren, J. L. Rannie, J. E. R. Ross, H. F. J. Lambart, H. U. Hart, H. B. Dwight.

SALE—CHARLES P., of 172 Sandwich Str., Ford City, Ont. Born at Windsor, Ont., Aug. 6th, 1898; Educ., B.A.Sc., Univ. of Toronto, 1921; 1920, production dept., Ford Motor Co.; 1921, service mgr., Walter A. Fuller Co.

References: J. C. Keith, W. J. Fletcher, H. J. Lamb, C. R. McColl, J. J. Newman.

WALLACE—ARCHER MCKAY, of Chatham, Ont. Born at Kingston, Ont., Sept. 30th, 1899. Educ., B.Sc., Queen's Univ., Kingston, 1922; 1920-21 (summers) foreman, building constrn. work, R. Wallace & Sons, genrl. contractors, Kingston; 1922, to date, foreman of reinforced concrete constrn., Canadian Des Moines Steel Co., Ltd., Chatham, Ont

References: W. P. Wilgar, A. MacPhail, D. S. Ellis, W. L. Malcolm, J. M. Campbell.

— THE —

ENGINEERING JOURNAL

THE JOURNAL OF
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OF CANADA

AUGUST 1922

CONTENTS

Volume V, No. 8

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Kingston Branch, Kingston, Ont.
Peterborough Branch, Peterborough, Ont.
Toronto Branch, Toronto, Ont.
Hamilton Branch, Hamilton, Ont.
Niagara Peninsula Branch, Niagara Falls, Ont.
London Branch, London, Ont.
Border Cities Branch, Windsor, Ont.
Sault Ste. Marie Branch, Sault Ste. Marie, Ont.
Winnipeg Branch, Winnipeg, Man.
Saskatchewan Branch, Regina, Sask.
Lethbridge Branch, Alta.
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THE

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VOLUME V MONTREAL, AUGUST 1922 NUMBER 8

British Columbia Professional Meeting

Vancouver B.C., June 16th and 17th, 1922.

Held under the auspices of the Vancouver and Victoria Branches

Vancouver offers facilities for a convention surpassed by no city on the continent and the natural advantages, with which were included ideal weather, combined with the native ability and energy of our Pacific Coast engineers, provided a gathering to be remembered with pleasure by all who attended. Great credit is due the men responsible for the detailed arrangements. Due to the courtesy of the Canadian Pacific Railway Company, an ideal assembly hall was available and at the disposal of *The Institute* during the convention, in the lower dining room of the hotel Vancouver.

Major George A. Walkem, M.E.I.C., Vancouver councillor, occupied the chair at the opening session at nine thirty a.m., Friday, June sixteenth, and extended a hearty welcome to all out of town visitors to Vancouver, giving a brief outline of the agenda for the day. Major Walkem then introduced Mayor C. E. Tisdall of Vancouver, who extended a welcome as follows: — Major Walkem and Gentlemen: It forms part of my duties to open conventions and I am particularly pleased to be here to-day because I realize that to no branch of men and no profession, is the west more indebted to than the engineering profession. Our city of Vancouver would not be here at all were it not for the engineering skill displayed in putting the Canadian Pacific Railway through the canyons of the Fraser, and I am glad to see in our midst to-day one of the men responsible for driving the rails through that celebrated piece of engineering work. I have looked through the programme for to-day and I hope that your deliberations will be of interest to you and I can assure you that in a social way you will be made particularly welcome to the city. I trust that the social side of your visit will leave pleasant recollections of Vancouver and I feel sure, with the beautiful weather that we have to-day and the weather that will continue for some little time, will be appreciated by you and will leave nothing but pleasant memories. I regret that my appearance this morning will not allow me to stop to hear the paper on town planning, on account of my colleagues being at the Good Roads Convention and some who are going to Portland next week. I am glad that town planning is being taken up by the engineering profession because there is ample scope in that direction. I welcome the engineers of Western Canada because they aid production and help us and assist us in an economical sense. I have only to say in conclusion on behalf of the city of Vancouver, how much we appreciate the honour you have done us in holding your convention here and to again

express the wish that you will have nothing but pleasant recollections of the convention here and of the social advantages of the city and the climatic advantages, and to assure you, if you ever decide to meet again in Vancouver, how cordially you will be welcomed and how glad we will be to see you all. I thank you.

The chairman thanked Mayor Tisdall for his sincere welcome and his appreciation of the engineering profession. He announced that the noon luncheon would be a joint luncheon of the Canadian Club of Vancouver and *The Engineering Institute,* addressed by the Honorable J. L. Perron, Minister of Roads, Province of Quebec, and that a group photograph would be taken on the court house steps immediately after the luncheon.

Vice-president Arthur Surveyer, was then asked to take the chair. Mr. Surveyer expressed his thanks for the honour, stating with his usual modesty that he felt

CHAS. BRAKENRIDGE, M E.I.C.
Chairman of the Vancouver Branch.

that the honour was not his as an individual, but as a representative of the Council of *The Institute.* Like all others who visit Vancouver, Mr. Surveyer spoke of the pleasure it gave him to be again in Vancouver, and paid a tribute to the kindness of Vancouver engineers.

Town Planning in British Columbia.

The chairman regretted the absence of James Ewing, M.E.I.C., of Montreal, the author of the opening paper, referring to him as one of the foremost exponents of the town planning idea. Chas. Brakenridge, M.E.I.C., chairman of the Vancouver Branch, then read Mr. Ewing's paper, "The Engineer and the Town Plan." Following the reading of the paper, which is published in another section of this *Journal,* discussion was given by H. M. Bigwood, A.M.E.I.C., secretary of the Victoria Branch and by W. B. Young, A.M.E.I.C., designing engineer, city engineer's department, Vancouver, both of which appear in the general section. In concluding Mr. Young referred to the work being done by the Board of Park Commissioners of Vancouver, saying that much was due them for the excellent state in which Stanley Park was kept and for the way in which it is controlled, the natural features of the park being maintained and at the same time provision being made for recreation grounds.

In the absence of W. B. Greig, A.M.E.I.C., municipal engineer, Point Grey, Major Walkem who is a councillor of the municipality, added to the discussion by pointing out what had been done in the way of town planning in that municipality. The provincial government was being urged to appoint a technically trained man whose profession was town planning, to draft an act applicable to the province of British Columbia, and he hoped that

P. PHILIP, M.E.I.C.
Chairman of the Victoria Branch.

a town planning Act would be drawn up under such auspices that the province would get the benefit. Continuing Major Walkem said: — "We have had some town planning in British Columbia. For the benefit of you gentlemen who are not residents of Vancouver I might say that pretty nearly all Vancouver, the present site of Vancouver, was owned by the C.P.R., in the old days. They did not do any town planning in Vancouver proper, but immediately on the outskirts to the south they developed a place called Shaughnessy Heights. They town-planned and contoured the streets and made a residential district of it. Eventually they turned that district over to the municipality of Point Grey with the improvements, which improvements cost the municipality far less than if the municipality had to do that themselves. Immediately to the south of that they opened another district which we call Shaughnessy Heights No. 2, and they

developed it in the same way, made nice wide streets, put in boulevards, cement walks, sewers and water pipes and everything, and they turned that over to the municipality of Point Grey absolutely free; that is, they saved the municipality of Point Grey an expenditure of perhaps a couple of millions of dollars and gave the people who purchased property there a fine site for residences and absolutely satisfied them so that they were willing to pay the increased price which enabled the C.P.R. to turn it over free to the municipality. That is one of the benefits of town planning and what Mr. Ewing refers to in his paper. In old Shaughnessy Heights I think the cost of development of a lot with 50 feet frontage is roughly $900 per lot. These figures are approximate, they are not accurate. In a section developed, and put on the market by the provincial government, a section of the city supposed to be for workmen's residences and laid out on the old rectangular system, a system which in England the government would not allow to be developed, practically a swamp, ward eight in this city, I think the cost per 50 foot lot ran up to over $2,000. You see how much cheaper it was to develop on the town planning system than the old rectangular system. I hope the discussion will be very full on this question because it is a question of vital importance to British Columbia."

P. H. BUCHAN, A.M.E.I.C.
Secretary-Treasurer of the Vancouver Branch.

HORACE M. BIGWOOD, A.M.E.I.C.
Secretary of the Victoria Branch.

Brig.-Gen. C. H. Mitchell, M.E.I.C., vice-president of *The Institute*, on being asked to add to the discussion, stated that he had been particularly interested in town planning for many years and was pleased to note that this subject was given the honour of being the first paper presented at the meeting. He thought that there were four headings in which the engineer should be interested in this subject. The first, what nature had done, second, what can be done by legislation, third, what a technical man could do in town planning, and fourth, what we as citizens could and ought to do to help. From the viewpoint of what nature had done he considered that in Vancouver and Victoria, with their wonderful scenery, their natural advantages should be availed of in this connection. Regarding legislation he suggested provincial legislation, whereby municipalities could take advantage of conditions to bring about good town planning. Ontario had been developing legislation and while not yet all that might be desired, it is progressing. He suggested the studying of legislation in other provinces. The literature on town planning was becoming extensive and could be used by engineers in its application to local conditions. As citizens, General Mitchell felt that the members of the engineering profession had not taken sufficient part in public affairs although in this subject we were particularly adapted by experience and education to take an active and progressive part. People were looking to the engineering profession to help in the question of town planning. In closing General Mitchell gave expression to his feeling that it was the duty of the engineer to assist in town planning in a more active manner, reflecting credit on the profession and adding to the beauty of the cities and the country.

Major J. A. Duchastel, M.E.I.C., chairman of the Montreal Branch, and chief engineer and city manager of Outremont, brought the greetings of the Montreal Branch to the meeting. Referring to the subject of town planning he mentioned the assistance to Vancouver and Victoria of having available luxuriant vegetation and the spirit on the part of the people in cultivating flowers and beautifying their homes. Conditions were different in Montreal as public property was largely

covered by pavements. In the city of Outremont town planning was being carried on with success. He was pleased to note the interest the engineering profession was taking in the important subject of town planning. He thought engineers, as citizens, could do much to reinforce and back up the work of municipal engineers. He regarded town planning, not merely a question of the development of playgrounds, the opening of parks and the beautifying of certain streets, but a rational development of the whole city plan and a subject in which the engineer could find a great deal of work, in fact a life work, in its application to the development of municipalities and cities. The chairman speaking as a citizen of the city of Outremont stated that they considered it was the best managed municipality in Canada.

A. F. Macallum, M.E.I.C., commissioner of works, of Ottawa, who was the official representative of the Ottawa Branch and also representative of the city of Ottawa at the Good Roads Convention, was asked to add to the discussion. He stated that the unfortunate part of town planning was that it had been sprung upon the profession by unprofessional people in an unprofessional manner. In some districts in the United States it was looked upon as a joke. In the city of Ottawa they had a federal plan drawn out in an artistic manner, but he thought it was to some extent impracticable because it would cost the city fifty or sixty million dollars to carry it out. In time, however, part of it could be carried out. They are now working together on practical details. In one district an elaborate scheme was gotten out as far as streets were concerned, but they did not take into account the fact that it was necessary to install water works and sewers. He instanced the economy of having alley-ways in a city. In garbage collection the cost being forty per cent more to collect garbage where there are no alley-ways. In a city of one hundred thousand population it would cost fifty-two thousand dollars to collect the garbage if alley-ways were provided, and eighty thousand dollars without; the difference representing the interest on half a million dollars. That was a practical detail that was not always considered. He spoke of the lack of a civic centre in Vancouver; the badly laid out city of Montreal, Toronto being worse, where there was need of practical town planning.

Professor Peter Gillespie, M.E.I.C., was asked to discuss the subject. He pointed out that one of the perplexities of town planning was the uncertainty of the growth of the population. He referred to an estimate of the population of Toronto made by a British expert in 1896, of three hundred and fifty thousand in 1940, whereas the present population is five hundred and fifty thousand. It required men of vision and special knowledge to enable them to solve the problems. Professor Gillespie told of the lectures given at the University of Toronto, to men whose employment was related to the government administration. The subjects discussed were, transportation, water-supply, sewerage, public health; and it was gratifying to know that in the opinion of those connected primarily with the course and those who observed its progress, that it was a very substantial advance in the direction of interesting the people in the province in town planning.

Major Walkem said he wished to put in a word for the real estate men. They are generally accused of caring for nothing except getting the dollars. Such was not the case in Point Grey, where real estate men were the keenest on town planning and, with the members of the real estate exchange of Vancouver, had sent delegation after delegation over to Victoria to interview the government in the interests of town planning.

Announcements

As there was no further discussion on the subject the chairman called on Fraser Keith to make some announcements. Mr. Keith said: — "Our President, Mr. J. G. Sullivan, of Winnipeg, has asked me to convey his very sincere regrets to you because he was unable to be present. Mr. Sullivan asks me also, in expressing his regret, to extend to you on his behalf a very cordial invitation to be present at the Winnipeg meeting. The invitation was extended from Winnipeg at the time of the annual meeting in Toronto last year, and the Winnipeg members have been making plans for a year and a half for a successful convention and it is hoped that a good many from the coast will be there. The meeting is on September 5th, 6th, and 7th." He read a letter from H. G. Wright, president of the University Club, extending the privileges of the club to all outside members of *The Institute*, stating that the club would be glad to make any special arrangements for the comfort of the members. He suggested that in view of the fact that no special arrangements had been made for dinner it would be advantageous if as many as possible would meet at six thirty at the University Club where a special table would be provided for as many as would care to come. He mentioned that an invitation was received for all members who desired to take an automobile trip through the Okanagan valley, as guests of the Boards of Trade of the interior cities, from Kamloops through the Okanagan valley and through the boundry country, Crow's Nest, Watertown lakes to Lethbridge and up the Windermere valley.

Luncheon

The meeting then adjourned to a joint luncheon with the Canadian Club of Vancouver in the hotel Vancouver, the speaker of the day being the Honorable J. L. Perron, Minister of Roads, Province of Quebec. Mr. Perron who had come west to attend the Good Roads Convention, gave an eloquent address on the subject of good roads, pointing out the practicability of a highway across Canada by the co-operation of the various provinces and the utilization of provincial roads for that purpose. He made the important announcement that the contracts were being let for a bridge across the Ottawa connecting Montreal with the mainland and that the near future would see a first-class highway connecting Montreal and Toronto. At the conclusion of the luncheon a group photograph was taken on the court house steps.

Visit to Ballantyne Pier

Following the luncheon with the Canadian Club, the members were taken by automobile to the ferry wharf for the purpose of visiting the Ballantyne pier and the

construction yards on the north shore, through the courtesy of A. D. Swan, M.E.I.C., and Wm. Smaill, M.E.I.C., chief engineer Northern Construction Company. At the ferry landing a tug and scow kindly supplied by Major Walkem, M.E.I.C., awaited the party, which was conveyed to the north shore, and an inspection made of the concrete columns and forms undergoing construction, to be used in the Ballantyne pier. The special phases of construction embodying the latest methods were pointed out, the product being of a very superior order. Following the visit to the construction yards the party was transported across the harbour to the pier, where many expressions of commendation were heard on the design and quality of work being carried out.

Irrigation in British Columbia

The evening session commenced at eight thirty p.m., the chair being occupied by Brig.-Gen. C. H. Mitchell, M.E.I.C., vice-president of *The Institute*. Owing to the fact that there had not been sufficient time for the paper on "Irrigation in British Columbia" at the morning session it was postponed until the evening. The chairman on opening the meeting called upon E. A. Cleveland, M.E.I.C., consulting engineer to the Department of Lands, Victoria, who read his paper, "Irrigation in British Columbia". This paper is published in the general section of this issue of *The Journal*. The discussion on irrigation took place at the morning session, Saturday, June seventeenth. Chas. Brakenridge, M.E.I.C., chairman of the Vancouver Branch, occupied the chair. P. J. Jennings, M.E.I.C., chairman of the Calgary Branch, acting assistant commissioner of irrigation for Alberta and Saskatchewan opened the discussion by complimenting the author on his excellent and interesting paper. He asked the author how the figures of the duty of water as set, of two and a half cubic feet per acre, obtained. Replying, Mr. Cleveland stated that the duty set at two and a half acre-feet was the general duty set for the granting of licenses for irrigation purposes regardless of the place. This was done to arrive at some general duty under which the board could allocate water to the various licensees. There was no scientific precision or accuracy for the setting of that duty; the experiments of the duty of water so far being more or less of a primitive kind. Mr. Jennings stated that in Calgary applications are received on streams which flow with a tremendous volume of water for a short period and all they give by grant is eight inches of water instead of the full eighteen inches, because storage is unavailable. Continuing in the discussion Mr. Cleveland stated that an apparent misapprehension exists, as to just where the duty of two and a half acre-feet applies, being the duty that a man might be allowed under a license, but it need not follow that that is all that the individual user of the water gets. The duty of two and a half acre-feet is the amount the company or district are entitled to take in general from the source of supply and they distribute it according to the needs of the user. Mr. Jennings suggested the difficulty there must be to administer a stream if on any one area a certain duty of water is required and in another area a different duty. The author pointed out that it is the business of the irrigation engineer to allocate the water and to introduce such rotations as are necessary, but to allow each his proporation of duty assigned under the license. When a company or district takes water from a creek or river the distribution, by them, to the users under them, is entirely a matter of interest to them and generally governed by agreement. In districts formed in the last two years the use is governed by officers in the district. He further explained that in the early days of irrigation the subdivider of the land sold the land subject to an agreement. This system had not been maintained. It was found that the works were obsolete and out of date in a few years. Mr. Jennings explained that the financial standing of the company was investigated before a grant was made, that the agreement made must be satisfactory to the government, and the land declared suitable and capable of carrying the water that the prospective enterprise has undertaken to deliver. He requested information as to the difference between an irrigation district and a water users' community, being told that a water users' community is an elementary and fundamental form of co-operative effort in a community. It might be called an association of neighbouring farmers, or orchardists, who have their own supply. Mr. Jennings thought it a hardship to have the water shut off as it eliminated the prospect of getting the taxes due, but Mr. Cleveland stated that this was the first year it was being tried in order to stimulate promptness and have every man assume his share of the burden. He mentioned further that the banks were helping finance the fruit growers. Speaking of the Federal side of irrigation, Mr. Jennings mentioned the eastern section near Calgary, which is hardly ten per cent settled, being in large areas; the Lethbridge Northern, under Mr. Muckleston, the United Irrigation District, the Macleod Irrigation District; the important problem being to get the people on the land. Holdings were being cut down from four hundred and eighty and six hundred and forty acres in dry areas, to eighty to one hundred, and one hundred and sixty acres under irrigation. In the Irrigation Department at Calgary, Mr. Jennings explained they have drainage basin records for ten years and thus have a fairly accurate run per acre-foot.

Major H. B. Muckleston, M.E.I.C., chief engineer, Northern Irrigation District, explained the process by which the irrigation districts are formed in Alberta, it having gone through the same stage as in any other country, the first stage being development on a small scale by individuals; the second, a partnership where two or three built a system; the third stage was the corporation system lead by the Canadian Pacific Railway Company, the last stage being by districts formed for development. He stated that no corporation would build an irrigation system because there was no money in the actual irrigation part of it, the process of irrigating the land taking such a long time that the accrued interest mounts up to a heavy capital charge. The form now in vogue was the irrigation districts. Any group of farmers may form themselves into a district. Generally some enthusiast secures signatures to a petition addressed to the Alberta government. The Minister of Public Works appoints a day on which an election is to be held and appoints a returning officer whereupon trustees are elected to carry on the affairs of the district and, after

the election being declared valid by the Minister of Public Works, the trustees must immediately appoint a secretary and a district engineer. The district engineer must be a member of the Association of Professional Engineers of Alberta. The engineer is then required to estimate the cost of the development of the irrigation district. When that is approved by the Minister, the second election is held in which the land holders vote as to whether or not they are willing to bond their land to the extent of the estimated cost. "If that vote carries," said Major Muckleston, "the estimate is placed again before the House in Alberta, and if it is favourably considered by the House, the province underwrites the bonds, guarantees the bonds, but it does so on two conditions; one condition is, that all land owned by any individual in excess of one quarter section, containing more than 160 acres of irrigable land, must be listed for sale, and sold, and when that is done the province will sell the bonds and construction begins. The province does not allow the fault which killed nearly every irrigation work in Alberta, and that is farming too much land. It is considered better to farm an acre thoroughly, than to farm two acres. The experience in connection with irrigation in Alberta would prove that. The first system built was unfortunate in the beginning, it was a long way ahead of its time. The first district formed under the Act was the Taber District, with 17,000 acres of irrigable land. They were lucky in having the C.P.R., do the job for them and take the bonds in payment, and after their first year's operation Taber District came through and every cent was paid off. Last year, the second year, their dues were paid without any recourse to the penalties which the Irrigation Districts Act provides.

In regard to the financing of the district after the construction and operating expenses are met, each year the Board of Trustees must prepare what is known as an assessment. They make an estimate of what the annual operating and maintaining charges are to be and to that they add the interest and cost of construction, and whatever sinking fund there may be for the debentures. They issue a notice in December to each ratepayer saying that his assessment for the coming year is so much. He has then until February to come in and pay the money. If he does not pay it by February he gets another notice and he has one month in which to pay the ten per cent value and if he does not the Board of Trustees put a notice in the Land Titles office and that man's land reverts to the district. They expropriate the land for delinquent taxes; they simply take the land. I think that is all I have to say."

W. B. Young, A.M.E.I.C., stated that it was interesting to note that in 1912 Mr. Dennis of the Canadian Pacific Railway Company, Mr. Fulton and Dr. Fortier of Washington, Sir William Wilcox and many other prominent men met in Kelowna, the report of the discussion being on record in the Western Canada Irrigation Association's book, marking a distinct step towards the solution of the problem with which water users were faced. Out of that came the first Act, the Irrigation Incorporation Act, but because of the lack of power or authority to the Minister of Lands and the comptroller under the Water Act, they were not able to make progress. In 1917 the present legislation was passed. Mr. Young outlined some instances leading to the change in the Act, the difficulty of financing, and paid a tribute to the early companies who had done much for the valley.

Referring to the bonds sold by irrigation districts in Alberta, Mr. Muckleston stated that they were an absolute first mortgage and held priority to any claim except that of the Crown, taking precedence to mortgages, seed liens, and any other encumbrances.

E. G. Marriott, A.M.E.I.C., Water Rights Branch, Victoria, being called upon by the chairman, mentioned the vital importance of irrigation and water to the products of British Columbia, as the possible future development of the city depended on the water. The solution of the use of the water being an engineering matter it was necessary that engineers should take every interest by familiarizing themselves with the Water Act, mentioning that copies were available on application.

Logging in British Columbia

Following the reading of Mr. Cleveland's paper, Chairman Mitchell called on Capt. T. W. Fairhurst, A.M.E.I.C., sales engineer, Vancouver Machinery Depot, who then read his paper, "Professional Engineering in the B. C. Logging Industry," published in the general section of this issue of *The Journal*, which as he explained was for the purpose of showing the history and advent of the professional engineer as applied to the logging industry in British Columbia.

Major Geo. A. Walkem, added to the discussion by stating that Capt. Fairhurst had brought the logs from the trees to the water, and he would explain how the logs were then brought to Vancouver, being boomed in rows of forty or fifty feet wide and boom sticks put around the outside and swifter sticks put on top at intervals. It is possible for tugs, used for towing the logs, to operate only in good weather as a sea will cause the logs to jump the boom sticks, the tugs standing the weather better than the raft. Towing is now carried on from a distance, he mentioned one instance of towing from Queen Charlotte to Anacortes. The best weather for towing is July and August. If logs are put in the water in March the teredo has them riddled before they could be towed to the mills. Nowadays the Davis system is used, being a cigar shaped raft with cables wound around. Major Walkem narrated some of the early experiences of logging in British Columbia and the difficulties encountered, stating that the engineering part of it was one of the most interesting phases of engineering that he had had anything to do with.

Continuing Mr. Walkem said, "When locomotives came out first, they used only the steam jam. There was no means of putting a brake on the trucks and the steam jam was sufficient for the locomotive and it was not necessary to use the engine as a compressor because you could block the wheels with a steam jam, but owing to the number of accidents they had created a Department of Railways, in British Columbia, whose functions—because they have no jurisdiction over roads with Dominion charters — is to deal almost entirely with logging

railways and locomotives. They got out a drastic set of rules prohibiting the use of disconnected trucks. That is, only a small percentage of disconnected trucks could be used; the others being replaced by skeleton cars. These were really pairs of trucks, but they were coupled together with the timber. On the bottom of the timbers were mounted the regulation Westinghouse air brakes, such as are used on the main line. To operate these you had to have an air compressor on the locomotive, and this air compressor could not be used for the locomotive; the theory being that the compressor on the locomotive was used on the cars alone and the engine itself was taken care of by the steam jam. If the man pumped up his air and thought he would try to handle the entire load with his locomotive, without having air sufficient to give his train a shot of air, if he started to go down a heavy grade, he must always keep his compressor pump up, so that his train does the braking and not the engine. That was a fruitful source of accidents in the old days, that is when they used the steam jam and not the air on the cars and consequently, in a pinch, a train was too heavy and simply jumped on and pushed the engine ahead and a wreck resulted. The inspectors will not allow the locomotive to take any of the braking work. If the inspector finds out he is trying to control the train with the weight of the engine and the steam jam he will cancel the engineer's certificate.

Mr. Mucklestone: That seems to be the opposite to the practice of the C.P.R. on the Field hill. They had to adopt the opposite practice. The theory was that anything a locomotive could pull up a steep hill they could pull down. The air brake was cut off at the tender and the whole thing was controlled by reversing the engine and putting a small jet of steam into the cylinder and the load was brought down by the engine acting as a compressor. When the train left Stephen the air brakes were cut off at the engine and it was brought down by the locomotive alone.

Mr. Walkem: That is absolutely contrary to the practice and the present superintendent of railways for British Columbia, at least the head of the Department of Railways, inspection department, is an old C.P.R., man, who spent most of his life on the C.P.R. and on his recommendation that part of the Act was drafted.

Mr. Lloyd: That difference might be due to the ratio of weight of a C.P.R. locomotive to the train, but there is quite a difference in the ratio of weight between the engine and a logging train.

Mr. Mucklestone: It was not on account of ratio of weight of the locomotive, but the reason behind it was the heating of the car wheels, the friction on the brake shoes over that nine miles of grade. They found by bitter experience that the tires came off the wheels sometimes.

W. H. Powell, M.E.I.C., asked the author the cost of a system of spar poles and head wire, stating that he understood it was from sixteen to twenty-five thousand dollars, to which Capt. Fairhurst replied that that was the cost with the engine included, seven or eight thousand dollars paying for all the rigging up to three thousand feet, being an approximation. To use duplex aerial skidders the outlay would cost twenty-nine to thirty thousand dollars. In answer to the question of the average weight of the logs pulled into camp he replied that they run from three thousand to ten thousand board feet per log and weigh up to five tons. In reply to a question from Capt. Everall, Capt. Fairhurst stated that an electric unit was equivalent to a steam unit, there being little difference, but that with an electric unit there would be a great saving in labour cost. H. P. Archibald, A.M.E.I.C., of Vancouver, outlined the old method of chuting the logs down a V-shaped chute which might be three-quarters of a mile long, water being turned on in many cases to prevent their taking fire owing to the friction of a heavy log going down a forty per cent grade. The meeting then adjourned.

Institute Affairs

Following the discussion on irrigation and before commencing the discussion of the affairs of *The Institute* as outlined in the programme, Chairman Brakenridge, expressed his gratification on seeing H. J. Cambie, M.E.I.C., present at the meeting; Mr. Cambie being undoubtedly the pioneer engineer of British Columbia. He extended him a hearty welcome and wished him many years of happy life, all present endorsing the chairman's suggestion by applause.

Institute Policy

It being now ten minutes past ten the chairman announced that the three speakers would have ten minutes each, leaving more time for discussion. He called upon Major W. G. Swan, M.E.I.C., who gave a discussion on the report of the committee on Policy published in the June *Journal.*

Major Swan mentioned having attended a meeting in 1910 and again in 1919, the Ottawa convention, and he found that in the meantime a new organization had sprung up being the result of the work of the committee on Society Affairs, under Professor H. E. T. Haultain, M.E.I.C., resulting in the change of name and the adoption of a broader policy. He pointed out that the present committee on Policy recommended a still further broadening of the objects of *The Institute,* enumerating them as follows: — (a) To develop and maintain high standards in the engineering profession. (b) To facilitate the acquirement and the interchange of professional knowledge among its members. (c) To promote the professional, the social and the economic welfare of its members, as may be deemed necessary for the maintenance of the honour and dignity of the profession. (d) To enhance the usefulness of the profession to the public, to make known its value, and to indicate means whereby it may be of service. (e) To encourage the establishment and the maintenance of appropriate educational facilities for the training of engineers. (f) To promote intercourse between engineers and members of allied professions, and to co-operate with other societies in broadening the usefulness of the profession. (g) To encourage original research, and the study, development and conservation of the resources of the Dominion.

Continuing, Major Swan discussed the report, as previously published for the benefit of the members, and

in some instances pointed out the reason for the conclusions arrived at by the committee. Before concluding Major Swan moved the following resolution:—

> THAT this meeting go on record as endorsing the proposals of the Committee on Policy as embodied in the report, pages three hundred and twenty-nine to three hundred and thirty-five of the June issue of The Engineering Journal.

Seconding the motion A. E. Foreman, M.E.I.C., a member of the committee, pointed out the important work done by the committee and the data and information collected, the published report being the result of a meeting in Montreal. There being little discussion the motion was put to the meeting and carried unanimously.

Legislation

Patrick Philip, M.E.I.C., chairman of the Victoria Branch, discussing the problem of securing adequate recognition for the engineering profession, expressed his belief that adequate legislation was a means towards that end and mentioned that legislation now existed in every province except Saskatchewan, and further, believed that it would be necessary to secure Dominion legislation and that could be effected by the active co-operation of the E.I.C. He quoted President Sullivan, in his address before the Victoria Branch as stating his belief that some day Dominion-wide legislation would be effected. Referring to the medical association with a Dominion-wide Act, he believed that engineers should have the same status. Mr. Philip moved the adoption of the following resolution:—

> THAT this meeting considers the subject of legislation of great importance to the profession and would advocate its inclusion in any statement of policy adopted by the Institute.
>
> It also suggests that the Institute by its action in launching the campaign for legislation, is the organization which can logically claim to be entitled to continue the excellent work already done, and to strive for co-ordinated legislation throughout the Dominion. Further, it is asked that this resolution be published in The Journal.

The motion was seconded by Wm. Smaill, M.E.I.C.

Secretary Keith stated that *The Institute* had not taken any active steps with regard to legislation in the various provinces. He outlined the history of the movement to secure legislation. A committee had been appointed consisting of representative engineers from all over the country who met at Montreal and decided to recommend that legislation be secured in the various provinces along the line of what was called a model Act. This was placed before the engineers in the various provinces without prejudice and left to the engineers, both members of *The Institute* and members of other bodies, to deal with; resulting in legislation in all provinces but one. Referring to Ontario, he reviewed the history of the effort in this connection, in that province, the final chapter of which was contained in a telegram to him from Willis Chipman, M.E.I.C., under date of June twelfth: "Bill finally passed House June fifth. Registration only granted. Engineers may continue to practice without registration. More open than Alberta. Act passed House Committees twice without serious amendment but at final reading was badly mutilated. Will continue to carry on." He understood that in Saskatchewan it was the intention to make a further effort to secure legislation with the next change of legislature.

H. S. Carpenter, M.E.I.C., Deputy Minister of Highways, Province of Saskatchewan, spoke of the efforts made to secure legislation in Saskatchewan, they being the first to present a Bill on behalf of the engineering profession. Last winter a Bill had been brought down that had the support of the Premier and Ministers but not as a government Bill. It had been so badly mutilated that they decided to withdraw it believing that they could later secure the full measure of protection. It is proposed to keep the matter alive and any help that other provinces could give would be welcome.

Mr. Foreman expressed his belief that support should be given to the provinces which had not legislation, but he did not think that it would do any good at the present time to try to procure Dominion legislation.

Other discussion pointed out the difficulty, or importance of doing nothing with Dominion legislation until uniform provincial legislation had been secured.

Professor E. G. Matheson, M.E.I.C., reviewed the history of legislation in British Columbia at some length, suggesting co-operation such as was used in bringing about legislation in British Columbia.

Capt. Everall, referring to the recommendation of the committee on Policy, on more effective co-operation with sister bodies in Canada and the United States, believed that an omission had been made by not including the British Empire.

An amendment was moved by Major Swan, M.E.I.C., and seconded by D. O. Lewis, M.E.I.C.:

> THAT this meeting recommend to the Council of the Institute energetic action be taken to secure Dominion-wide legislation as soon as adequate legal protection to practice has been secured in all provinces.

The amendment was put to the meeting and lost, the motion was then put and carried.

Welfare of Engineers

Psychology

The welfare phase of *Institute* activities was introduced by D. O. Lewis, M.E.I.C., who discussed it under the headings, of psychology, publicity and legislation. Dealing with psychology, or personal attitude in relation to the engineers' welfare, Mr. Lewis pointed out in no uncertain manner that the engineering profession had been directly responsible for the great advance of civilization, so that the poor man lives to-day in greater security and comfort than did the richest baron in feudal times. Yet on account of the fact that we have been too clannish, too narrow, and had not interested ourselves in the social, political and business welfare of the country, we had not received the recognition of which we were entitled. By becoming specialists and devoting our energies to a narrow field we had become animated tools working for the benefit of society and relegated through life to a subordinate relationship to the business man, who with a greater knowledge of men and affairs is able to dictate and control our field of action. Continuing, Mr. Lewis asked the question, are we playing up to our opportunities, to which he gave a negative answer, stating that if we aspire to a higher plane in society we must not only understand how

to direct the forces of nature, but we must also get what we want done and direct the doing. He advised, in addition to the study of dead worlds of matter and force, a study of the live issues of the country, where we could obtain a broader vision and cultivate more human interests and associations. It was necessary therefore to change our mental attitude before we could look forward to more beneficial results.

Publicity

On the subject of publicity Mr. Lewis pointed out that while good works spoke for themselves, generally speaking the engineer does the work, but as soon as it gets to a point where it is appreciated by the public, he is in the background and the talkative business man in the foreground. He believed we should have quiet publicity to give the public an idea of what we are doing, and the work we are doing, in a modest manner, then they would know who was doing it. Publicity that would let the world know definitely that what the engineer does is needed. He referred to the formation of an engineering luncheon club in Vancouver, at which engineers could lunch together, the idea being to interest people from other associations, such as the Rotary Club and the Kiwanis Club, and also have engineers talk to them.

Legislation

One of the most important things in connection with legislation, Mr. Lewis believed, was reciprocity both with the different provinces and with the United States, particularly the latter. It had been stated in British Columbia that mining investors would not take up propositions in the province if the Bill were passed, but provision has been made to apply to investors desiring to bring their own engineers. He mentioned an invitation from Indiana to reciprocate and believed that reciprocity would be a great advantage. (Applause.)

British Columbia Provincial Division

While this had been a subject before the members throughout British Columbia, Major Walkem, M.E.I.C., felt in discussing the subject, that in view of the recommendations of the committee on Policy whereby all members would be connected with Branches and thus be in closer touch with *Institute* affairs, the matter was not pressing and might well be laid over for a year. In view of the fact that the Branches were being given further freedom and more direct representation, the necessity for provincial divisions is not so great. After discussion on the subject by Messrs. Carpenter, Walkem and Keith, it was resolved on motion by Major Walkem, seconded by D. O. Lewis:

THAT the question of establishing a Provincial Division in British Columbia be dropped for the present

Motion carried.

The following resolution was presented to the meeting by Major Walkem, seconded by W. H. Powell, M.E.I.C.:—

WHEREAS this convention recognizes the growing importance of town planning, and

WHEREAS The Engineering Institute of Canada have for some time recognized town planning as a separate and exact branch of engineering, and

WHEREAS this convention believes the time is now ripe to urge upon the various governments, Federal and Provincial, the creation of departments, or machinery of some sort to supervise and carry out town planning, be it resolved, therefore;

THAT we urge the Council of The Engineering Institute to bring before the government the necessity of creating the department and appointing proper officials so that town planning will be given a place in the government that its importance entitles it to.

The resolution was adopted.

Resolutions of Thanks

At the conclusion of the discussion on *Institute* affairs, Major Duchastel moved the following votes of thanks:—(1) That the appreciation and thanks of this assembly be extended to the City of Vancouver, for the address of welcome from Mayor Tisdall, for the hospitality extended in the visit to the Seymour intake. (2) Vote of thanks to the C.P.R. officials for providing facilities for this meeting. (3) Vote of thanks to A. D. Swan, M.E.I.C., Northern Construction Company (Wm. Smaill, M.E.I.C., chief engineer) for the privilege of visiting the construction yards and the Ballantyne pier. (4) Vote of thanks to Major Geo. A. Walkem, M.E.I.C., for providing "safe" water transportation for the visit to the construction yards and pier. (5) Vote of thanks to the authors of the papers and those who prepared different discussions and took part in the discussions. (6) Vote of thanks to the University Club for extending their courtesy to the visiting members. (7) Vote of thanks to the owners of automobiles who kindly loaned their cars for the benefit of the members. (8) Vote of thanks to the committee and those who worked and made this meeting a success. Brig.-Gen. Mitchell, M.E.I.C., seconding the motion, that the above votes of thanks be passed, stated that those who came from a distance, particularly, appreciated all the attention that had been given. The votes of thanks were unanimously passed in one motion.

Entertained by City

The City of Vancouver, through City Engineer Fellowes and Alderman Col. T.H. Tracy, M.E.I.C., acted as hosts, on Saturday, when a party was entertained to luncheon at the water-works intake on Seymour creek. Leaving the hotel Vancouver at eleven thirty A.M. in twelve automobiles, the party crossed the inlet and proceeded up Seymour valley, stopping at various places to view the canyon. Dinner was provided at the big log cabin at the Scott ranch. A. F. Macallum, M.E.I.C., Commissioner of Works, Ottawa, expressed the thanks of the visitors for the hospitality of the City. Other speakers were Alderman Tracy, M.E.I.C., F. L. Fellowes, Professor E. G. Matheson, M.E.I.C., of the University of B. C., Col. G. K. Kirkpatrick, chairman of the Harbour Board, P. J. Jennings, M.E.I.C., Federal Irrigation Department, Calgary, Thomas White, M.E.I.C., engineer of the Canadian National Railways, Chas. Brakenridge, M.E.I.C., chairman of the Vancouver Branch of *The Institute.*

British Columbia Professional Meeting
Vancouver, B.C., June 16-17, 1922

Key to B. C. Professional Meeting Group Photograph

1 T. E. Price
2 Fraser S. Keith
3 E. G. Matheson
4 J. A. Duchastel
5 A. W. Vassar
6 Wm. Smaill
7 Thos. White
8 J. R. Grant
9 E. F. Cooke
10 G. J. Rayner
11 G. A. Walkem
12 P. H. Buchan
13 Wm. Anderson
14 A. Dixon
15 J. M. Wardle
16 A. Lighthall
17 J. N. Finlayson
18 E. A. Jamieson
19 C. H. Mitchell
20 Arthur Surveyer
21 A. F. Macallum
22 Newton J. Ker
23 L. F. Pearce
24 H. A. Icke
25 H. B. Muckleston
26 C. T. Hamilton
27 D. M. MacDonald
28 A. A. Young
29 W. G. Swan
30 Peter Gillespie
31 J. N. Anderson
32 H. W. Frith
33 H. P. Archibald
34 E. A. Cleveland
35 D. O. Lewis
36 E. H. James
37 J. T. Breckon
38 E. G. Marriott
39 H. S. Carpenter
40 G. H. Burnett
41 T. W. Fairhurst
42 S. B. Birds
43 J. A. Walker
44 J. McHugh
45 E. L. Tait
46 R. G. Swan
47 Wm. McG. Young
48 C. E. Webb
49 G. P. Stirrett
50 D. R. Cameron
51 A. D. Creer
52 R. P. Wilson
53 P. J. Jennings
54 Prof. K. A. Clark
55 L. F. Merrylees
56 Jas. Muirhead
57 W. B. Young
58 S. Anderson
59 H. M. Lloyd
60 A. C. Eddy
61 C. Brakenridge
62 G. F. Fountain
63 W. H. Powell
64 E. D. Todd
65 W. M. Everall
66 H. S. Van Scoyoc
67 A. F. Mitchell
68 H. M. Bigwood
69 A. D. Swan
70 H. Idsardi
71 G. W. Tornroos
72 P. M. Smith
73 H. G Randlesome

British Columbia Professional Meeting

Vancouver, B.C., June 16th and 17th, 1922.

Registration

Name	Address
Geo. A. Walkem	Vancouver.
W. M. Everall	Victoria.
H. A. Icke	Victoria.
W. A. MacKenzie	Vancouver.
P. H. Buchan	Vancouver.
C. Brakenridge	Vancouver.
W. H. Powell	Vancouver.
J. Alex. Walker	Vancouver.
J. A. Duchastel	Montreal.
Mrs. J. A. Duchastel	Montreal.
Ernest C. W. Lamarque	Vancouver.
E. A. Cleveland	Victoria.
E. G. Mariott	Victoria.
Ross Thompson	Vancouver.
J. McHugh	Vancouver.
Peter Gillespie	Toronto.
Fraser S. Keith	Montreal.
Reginald P. Wilson	Vancouver.
J. N. Anderson	Vancouver.
T. H. White	Vancouver.
F. Pardoe Wilson	Vancouver.
H. M. Lloyd	Vancouver.
T. Rognaas	Victoria.
Arthur Surveyer	Montreal.
W. Anderson	Vancouver.
S. Anderson	Vancouver.
H. S. Carpenter	Regina.
Mrs. H. S. Carpenter	Regina.
C. A. Mullen	Montreal.
C. E. Webb	Vancouver.
Thurstan Fairhurst	Vancouver.
Alex. A. Young	Winnipeg.
Mrs. A. A. Young	Winnipeg.
D. O. Lewis	Vancouver.
H. K. Dutcher	Vancouver.
H. R. MacKenzie	Regina.
Hugh W. Frith	Vancouver.
Wm. Smaill	Vancouver.
G. F. Fountain	Vancouver.
E. F. Cooke	Victoria.
H. M. Bigwood	Victoria.
A. F. Mitchell	Victoria.
C. S. Gzowski, Jr.	Toronto.
M. H. MacLeod	Toronto.
J. M. Wardle	Banff, Alta.
R. G. Swan	Vancouver.
J. Muirhead	Vancouver.
H. S. Van Scoyoc	Montreal.
S. B. Birds	Vancouver.
J. D. Robertson	Edmonton.
Mrs. J. D. Robertson	Edmonton.
Wm. Brand Young	Vancouver.
Charles D. Williams	Vancouver.
A. D. Creer	Vancouver.
Arthur Dixon	Prince George, B.C.
A. C. Eddy	Vancouver.
A. W. Campbell	Ottawa.
A. E. Foreman	Vancouver.
H. P. Archibald	Vancouver.
W. G. Swan	Vancouver.
L. F. Merrylees	Vancouver.
P. J. Jennings	Calgary.
Newton J. Ker	Vancouver.
Major J. R. Grant	Vancouver.
William Young	Vancouver.
Chas. T. Hamilton	Vancouver.
E. A. Wheatley	Vancouver.
J. B. Parham	Vancouver.
D. Roy Cameron	Kamloops, B.C.
K. A. Clark	Edmonton.
A. S. Wootton	Vancouver.
J. T. Breckon	Murrayville, B.C.
A. F. Macallum	Ottawa.
R. Watson	Vancouver.
L. T. Pearce	Vancouver.
C. H. Mitchell	Toronto.
H. G. Randlesome	Vancouver.
Thos. L. Knight	Chicago.
E. G. Matheson	Vancouver.
D. M. Macdonald	Vancouver.
Wm. Pearce	Calgary.
G. P. Graham	Albany, N.Y.
George J. Rayner	Victoria.
Geo. S. Boulter	Vancouver.
H. B. Muckleston	Lethbridge.
John Dow	Lethbridge.
C. J. Fox	Vancouver.
C. H. Fullerton	Toronto.
J. N. Finlayson	Winnipeg.
A. D. Swan	Montreal.
G. H. Burnett	Hammond, B.C.
J. S. Connell	Vancouver.
G. P. Stirrett	Vancouver.
T. H. Tracy	Vancouver.
E. Dundas Todd	New Westminster, B.C.
Mrs. A. M. Rankin	Collin's Bay, Ont.
G. W. Tornroos	Vancouver.
E. A. Jamieson	Vancouver.
A. Lighthall	Vancouver.
H. Idsardi	Vancouver.
N. K. Gwyer	Penticton.
A. W. Vassar	Vancouver.
P. M. Smith	Vancouver.
J. G. MacLachlan	Kamloops.
E. L. Tait	Vancouver.
Maurice Helzer	Vancouver.
R. S. Perry	Vancouver.
J. W. B. Blackman	North Vancouver.
R. Rome	Vancouver.
Jos. B. Winter	Vancouver.
T. W. W. Parker	Vancouver.
T. E. Price	Vancouver.
Miles P. Cotton	Vancouver.
Chas. L. Bates	Vancouver.
H. Carry	Vancouver.
Geo. S. Hanes	North Vancouver.
P. Philip	Victoria.
A. L. Carruthers	Prince Rupert, B.C.
A. T. Laing	Toronto.
H. J. Cambie	Vancouver.
G. R. Kendall	Vancouver.
J. P. Hodgson	Vancouver.
W. R. Bonnycastle	Vancouver.
B. E. Norrish	Montreal.
W. P. Gross	New Westminster, B.C.
L. B. Elliot	New Westminster, B.C.
H. L. Johnston	Victoria.
A. McCulloch	Penticton.
H. M. Burwell	Vancouver.
Robt. J. Lecky	Toronto.
R. F. Leslie	Vancouver.
F. W. Anderson	Kamloops.

The Engineer and the Town Plan

James Ewing M.E.I.C.

Consulting Engineer, Montreal;

Vice-President, Town Planning Institute of Canada.

Paper Read before the British Columbia Professional Meeting of the Engineering Institute of Canada, Vancouver B. C., July 16th, 1922

The actual planning of towns and cities is a science to which municipal engineers as a rule have given far too little thought and attention, notwithstanding that it is the main governing and determining factor in their work. In the west especially, the pioneer influence of the railways is the prime initiator of the town and the city, and railroad economics, exigencies and requirements the paramount consideration. With the railway station as the nucleus of a rudimentary rectangular layout, the town is started off to grow and take care of itself in growing.

Then the real estate operator gets to work and takes a hand in the movement. Such notions as the development of the land to the best advantage and accommodation of the community are usually foreign to him. He is not interested in holding and improving the land but only in getting rid of it, receiving the biggest turnover in the shortest possible time. Therefore all economic, hygienic or aesthetic considerations are entirely outweighed by the easiest and cheapest layout that can be got.

When the town grows apace and aspires to the status of a city, the services of the municipal engineer is commissioned and in nine cases out of ten he accepts and falls in with the existing situation unquestioningly. He applies his knowledge and energies assiduously in determining the most efficient and economical design and construction of the necessary public utilities; he is most careful and painstaking regarding the source, distribution and treatment of the water supply, the correct grades and capacities of the sewerage conduits, as well as the ultimate disposal of the sewage, and the proper ingredients, handling of materials and most durable types of street paving. The basic question, however, of what a street is for, is seldom or ever entered into analytically, the present and prospective volume and trend of street traffic is usually disregarded, and the general development along rational and economic lines left uncontrolled until it becomes practically uncontrollable.

Perhaps it is hardly fair to put the blame on the engineer who generally speaking is asked to study and advise on certain phases of the subject and is paid for that, while unsolicited recommendations would be unappreciated and possibly even resented. The fault lies rather with the authorities who employ him, or with the taxpayers themselves who are always urgently clamouring to see something tangible for their money, but the misfortune falls on the entire town which forever afterwards must go on struggling under disabilities which could easily have been obviated in the beginning.

Importance of Planning for the Future

The great trouble is that the need for town planning is never imperative and seldom even apparent till its cost becomes prohibitive. It is only after most of the damage has been done, when the water and sewerage systems have been installed, pavements laid, tramways constructed, and many more or less valuable buildings erected, that the inherent weakness and sheer inadequacy of an ill-considered rule-of-thumb layout becomes evident. It will then be found in most cases that the main streams of street traffic have to follow along indirect routes over thoroughfares of insufficient capacity, with the principal crossings blocked and congested, notwithstanding the fact that at the same time there are plenty of other streets of extravagant width over which there is no traffic to speak of, and where it may be said that fifty per cent of the cost of paving those streets has been, both literally and figuratively, money thrown in the gutter.

Then too, the perilous and paralysing effects of the level railroad crossing assumes prominence, becoming a real calamitous condition calling loudly for redress. Soon also we find, owing to unregulated and uncontrolled development, the factories springing up promiscuously all over the place and spreading in their neighbourhood ugly, malodorous and grimy conditions, forcing up the cost of land but depreciating residential values with the inevitable consequence that buildings fall into disuse, decay and delapidation, and the foul reeking cankerous slum is created.

Following upon that a well defined movement is instituted from the centre towards the circumference of the city, first of the residences seeking more wholesome surroundings, followed by the shopping and lighter industrial establishments, and last of all by the factories themselves, who finding themselves cramped for elbow room and bereft of a nearby steady and reliable labour supply, start to get after it and begin to build up on the outskirts, there to create afresh new plethoras of slums. In this way a huge volume of really unnecessary street traffic is formed, under which the pavements soon crumble and have to be renewed, only to be torn up again in order to install larger and more adequate water, sewerage and power services to meet industrial requirements. Main thoroughfares must be widened at tremendous cost or new traffic avenues opened up. Building, tearing down and rebuilding becomes the order of the day, and so goes on the everlasting merry-go-round which leads nowhere, for the cycle is never completed. It is a constant ever widening spiral following along in a blind way without objective, and the waste is tremendous, the lost and dissipated effort incalculable.

This may be said to be a faithful picture of the history and condition of many a real live, progressive and up-to-date western town. Having arrived at the stage above described it might well be conceived to have learned its lesson and be prepared to mend its ways, but what was formerly a little playful calf has now become a ferocious bull that it requires some resolution to tackle. For unfortunately what was the easiest thing in the world at the commencement has by this time become practically impossible and can only be partially remedied even at tremendous cost. Difficulties that at first were only slight deterrents have kept on increasing not by simple progression but by ratio of squares and have assumed the proportions of insurmountable obstacles. The longer the delay the further and further the objective gets out of reach, until there comes a day when absolute dire necessity compels, and improvements and rectifications must perforce be made regardless of obstacles and regardless of cost, when millions can not accomplish what a few hundreds would have done in the beginning.

With all the talk about town planning in recent years, its real purpose is quite commonly misunderstood. The most widely prevailing and persistent misconception is that it has mainly to do with 'frills', and is linked up in the general mind with ambitious schemes of embellishment, stately and imposing civic centres, elaborate and extravagant boulevards, and parks and plazas resplendent with foliage, fountains and monuments. Now it should be clearly recognized that these things however nice in themselves are neither of major nor urgent moment, and if they come into it at all are merely incidental. It should be remembered that a city may have all of these things and yet organically be poorly planned, indeed some of them are often in themselves conspicuous examples of radically bad planning.

The Transportation and Street Traffic Problem

A city is not a mere indiscriminate collection of bricks and stones; it is a living breathing, pulsating organism like the human body, and a well planned city is one which performs its various complex and interdependent functions with the greatest ease and efficiency, and the least interference one with the other, or liability to interuption or breakdown. Just as in the human body, the most vital of all these functions is the circulatory movement, and if any part of it becomes impaired or congested the result is more or less general atrophy.

The transportation or street traffic problem is therefore of basic importance. Here it may be said that one can well imagine what would happen to the human body if all our veins instead of being proportioned according to the amount of work they are required to perform, into main arterial, secondary and minor distributary systems, were all about the same size. No engineer worthy of the name would think for a moment of designing water and sewerage services with pipes all of one dimension, and yet in making provision for our street traffic that is exactly what we do with our streets.

At the root of the traffic problem lies the railroad transportation question, and it is all the more important because it is the rigid framework affecting and governing all the rest. In the West more especially, the railways have the advantage usually of having got there first, or at least one of them has, and if the town shows any disposition to grow or become a progressive centre, we may be quite sure that other competitive roads will follow, each of course wanting to come in over its own right of way, and generally about the same level as that of the streets. So we frequently find these rival roads with their subsidiary and connecting spurs forming together a regular network of tracks, paralysing the street traffic and compressing the very vitals of the city in a grip of steel. It is futile to expect any healthy vigorous movement or progress under conditions like that, since what should be designed as the useful and helpful adjunct of the other are in perpetual self destructive conflict.

Railway transportation in the city is therefore the primary problem confronting the town planner, and the unification of roadbeds, if not of tracks, as well as the separation of grades to the greatest possible extent, of the utmost moment. Experience has abundantly proven the entire futility of approaching a serious and complex subject like that in a fractious or contentious manner. The solution, or partial solution, for it is at best a matter of compromise, can only be arrived at with the help of the railways themselves, each interest joining in a co-operative and conciliatory spirit for the ultimate benefit of all concerned.

Zoning

Next to the railroad transportation question is the problem of "zoning", or "districting", as some prefer to call it, in such a way as to afford protection to the residential element and at the same time give the utmost facility for the carrying on of manufacturing, industrial, and commercial operations, for these are the bones and sinues of the city corporate, without which it could only hope for a flabby and ephemeral existence.

We have observed the deleterious effects of allowing factories to spring up anywhere and everywhere they have a mind to, noticeably wherever they can find the cheapest land. They should be confined to districts close and convenient to the lines of railroad and water communication. It will be seen at once that this will reduce to a minimum the heavy cartage and consequent destruction of street paving. This cartage should be guided along main thoroughfares specially constructed to be able to withstand it, affording corresponding relief and saving to the streets in the other portions of the town, where the paving can be of the lightest nature at the least cost. By keeping the factories together in districts by themselves special provision can be made for giving them, in economic and concentrated form, all the facilities for carrying on their work, ample water, sewerage, lighting, heating, and power services, as well as special fire protection. This, too, affords corresponding relief to the other districts where these utilities need only be such as are requisite for domestic requirements. That the sanctity, reserve, and amenity of the home should be held inviolate as a retreat from the turmoil and tumult of the day, seems a truism, and for that reason purely residential sections should be created and kept free of invasion from industrial and business concerns.

Even if there were no other benefits the stabilizing and enhancing effect that this zoning has upon land values is one that cannot be lightly estimated, and might be graphically represented by a gradual upward curve instead of by a series of sharp fluctuations indicating periods of feverish speculation and inflated values followed by subsequent reaction and depression.

Planning Streets to meet Traffic Requirements

To provide efficiently and economically for the flow of traffic, the streets should be proportioned and graduated according to the service they are called upon to perform, with due regard to the future. Main thoroughfares should be direct routes, and for that reason, if for no other, the rigid rectangular layout is wasteful and inadequate in a town aspiring to any greatness. In residential sections all through traffic should be as much as possible discouraged. The streets may be laid out winding with occasional breaks, and the roadway should only be of such width as to accommodate merely local traffic. The building line should be set back to ensure provision for air space, and a sincere endeavour made to emulate a park-like appearance.

The advent of the automobile and the heavy motor truck has revolutionized the problem of street traffic and the paving of streets, creating not only an excessive volume of traffic hitherto undreamt of but exercising new destructive forces to paving. The street parking problem and the question of the ubiquitous garage are also assuming such proportions as to become a real public menace, requiring not only regulation but special provision.

Since it will be found that most of the congestion of traffic in our main thoroughfares occurs at the principal crossings, the corner curbs of these should be well rounded in order to facilitate the digestion of accumulated traffic. For the more important crossings a radius of not less than 25 feet should be established, which is equivalent in its effect to widening a street ten feet throughout. The minimum radius for less important crossings should be fifteen feet, which is the minimum radius in which an automobile can turn and remain normal to the curb. In cases of extreme congestions, circles should be provided to afford the necessary easement.

Parks and Playgrounds

The matter of parks and playgrounds is one of the most essential to conditions of health and well-being; these are the "lungs" of the city. Their ample provision, and convenient and equitable distribution, is of vital moment. They should be acquired well in advance of building development before increasing land values have rendered their acquisition prohibitive. It is not sufficient to have a few isolated patches of ground to be used as parks. There should be a regular park system, linked up with tree-shaded driveways. From a commercial and money making point of view, if for nothing else, this is a splendid investment, for we should not fail to remember that it is the well dressed shop window that catches the customers.

In city planning, as with nearly everything else, a good clean start is half the battle, but if mistakes have been made, as is nearly always the case, the sooner they are rectified the more can be accomplished, and with greater ease and at a much lower cost. If in the already built-up portions of some cities conditions may be considered almost past redemption, which is seldom absolutely the case, that is a very good reason why they should start to work on the outlying portions and do their planning well in advance, laying out their main thoroughfares, parks and recreation grounds, and regulating and controlling all prospective development. Generally speaking it is just beyond the city's boundaries that most of the atrocities are being perpetrated, and there are more slums in the making in the green fields there, than in the heart of the city. For that reason every growing city should annex and control all the land from three to five miles beyond its boundaries while it is yet in the agricultural state, which condition should not be disturbed until absolutely necessary, but the prospective development should be clearly mapped out.

Unsystematic Planning Expensive and Disappointing

A word of warning must be uttered against piecemeal planning, carrying out isolated bits of street widening or extension, a park here and a boulevard somewhere else, according to no well defined scheme or purpose. It is about the best way, to get the least benefit from the most money, one can possibly think of, and unfortunately it is just the kind of planning that appears to have the strongest appeal to the average civic mind. Equally delusive in its inception as it is disappointing in its results, and invariably ending in a hopeless muddle, it is the greatest deterrent to all future sound and well considered planning or effectual improvement. To get real results the whole question must be tackled and studied in a comprehensive way, giving careful heed to all the factors in a city's development, each being indissolubly linked with the other. When a good general plan is prepared there is a clear objective to work up to in a systematic way. It by no means follows that it must be carried out all at once, but only step by step as occasion warrants and means can afford. The well considered ambitious plan is not always the most expensive, but the indifferent one is usually the least economical and the most costly in the long run.

The greatest deterrent to the advancement of town planning is the prevailing idea that it is something frightfully expensive. That depends largely on the kind of planning, whether it is projected on sound, rational, and economic lines, or indulges mostly in fanciful and extravagant embellishment. It also depends to some extent on enabling legislation. Under the principle of excess condemnation, expropriations can be made and wonderful improvements may be, and have been, carried out in such a way as to pay for themselves entirely, giving all the advantages for nothing, and largely increased land values besides.

To do nothing and let things take their blind and wayward course, unguided and untended, is in the long run the costliest way of all and there is nothing left to show for it but a poor inheritance of everlasting trouble, inconvenience, stunted growth and lowered vitality in the community.

There are, however, other things in life which cannot be measured by mere monetary standards; good health, the joy of living, a fine communal spirit, and a just pride in being "citizens of no mean city". These are, after all, about the only things that are really worth while.

Discussion on The Engineer and The Town Plan

H. M. Bigwood, A.M.E.I.C.

Chief Draughtsman, Public Works Department, Victoria, B.C.

In opening the discussion on the paper presented by Mr. Ewing, by reason of more limited experience with the practice of town planning, the following remarks will be confined to elementary but none the less important principles and endeavour to bring forward one or two particular points especially applicable to British Columbia. The foundation for all planning, urban or otherwise, is the subdivision of land, and the conditions under which the subdivision is made will very largely determine the desirability of the town or city, which arises from a public welfare point of view.

The division of land into rectangular blocks as is regularly practised, even on prairie country, is often unsatisfactory and road allowances along a straight line in any direction, through good or bad land, swamps and hills, can hardly be considered the ideal situation for them economically. In our own province, where the terrain is anything but flat, such a system is useless, the topographical conditions are such that every subdivision demands individual consideration.

The primary object of the owner of the land, in subdividing, is to profit himself. He is not founding a philanthropic institution, but is, by making provision for closer occupation, hoping to sell for more than he paid. The people who are to occupy the land, as well as the public generally, will be adversely affected if the conditions resulting from poor planning or lack of consideration for others are detrimental to the welfare of the community. Therefore some restraint must be excercised and by making the subdivider carry out part or all of the improvements such as roads, drainage, water mains and so forth, deterring action may be secured.

The street plan must be laid out so that necessary work may be economically done and heavy construction work eliminated if possible, and in fact so arranged as to location and widths of streets, size of lots, drainage and provision for open spaces, that the community, as it develops, will be able to do so to the benefit of the majority of its members. The problem then is one to be undertaken by men whose training enables them to deal with such work in an efficient manner.

Whenever regulations or restrictions are imposed on subdivisions, such regulations must be justifiable, considered in the light of the public good, and not arbitrary. We have some in various forms already, but in some cases they might be of greater benefit if more definite. Thus, while plans must be approved by a specified official, before registration and the official's powers permit him to demand sufficient information to enable him to decide whether or not the engineering features can be economically carried out, yet a definite obligation for contours to be shown in all original plans of subdivision would help materially. Next, the size of lots and widths of streets must be regulated with regard to the area, business or residential, in which they occur. The building lines along residential streets should also be defined. The subject expands, until we find ourselves confronted with a much larger problem than simply the subdivision of the land, whether in or near a town.

As the paper points out, the need for town planning is not evident in the initial stages. It is only as evil results, arising from small lots, crowded dwellings, bad sanitation, lack of open spaces and congested traffic conditions, become evident that the need for comprehensive planning, or re-planning, is realized.

Is it possible to legislate in such a manner that land now wild or agricultural, when subdivided for profit, will be economically or advantageously laid out with due regard to the best interests of the purchasers and the country, when the site will be the living and working place of a large and busy community? Can we ensure that in every case proper restrictions as to business and residential areas, buildings, streets, open spaces and the other necessarily co-related matters will be imposed judiciously, or must it be always left to chance with the almost certain results described by Mr. Ewing in his paper?

Most cities have some regulations affecting the questions of housing, sanitation and so forth, which are partially effective, but it would seem advisable, particularly when a town is established and its growth assured, to provide for definite planning ahead.

To do this intelligently, the work should be supervised by a body having control of a larger area than the town itself. A town planning commission upon which the town and adjacent municipalities could be represented, but subject to the approval of a government department such as the Department of Public Works through a Town Planning Branch, might be effective. In this way you would control the development of the community and provide for expansion along rational lines in well ordered sequence, economically and with proper regard to the principle of the greatest good for the greatest number.

W. B. Young, A.M.E.I.C.,

Designing Engineer, City Engineer's Department, Vancouver, B. C.

It is unfortunate that Mr. Ewing was unable to be with us to present his paper, but we are indebted to him for his illuminating exposition of a subject in which all professional men and thoughtful citizens are interested.

We are striving after the general betterment of conditions. The present state of unrest in large cities is probably due to the fact that a series of economic conditions are fast coming into conflict with one another and the masses of the people are finding themselves in the zone of fire. Mr. Ewing has outlined to us in a very forceful manner the many difficulties with which we will be confronted if the principles of town planning are neglected. The basic principles of the town planner — call him an idealist if you will — are the betterment of human

existence, and the highest form of public service is surely that which plans to bring rest out of a state of unrest. Just so long as you have the commercial, industrial and residential elements of a city elbowing each other for breathing space, so will that state of unrest exist.

It is sound practical business to town plan. Good residential areas and proper housing conditions will give us healthy citizens. Properly located commercial centres will facilitate the transaction of business, and industrial sites allocated to their logical quarters will simplify questions of transportations and reduce to a minimum the cost of traffic arteries. There is no worthier or nobler object that can attract the sympathetic and practical co-operation of great citizens and enthusiastic men and women than town planning. The ideal — the very best — is the only goal worth striving for.

There is no fairer city the length and breadth of this great land than Vancouver. We are all fully conscious of her business potentialities, her wonderful climate and the unsurpassed beauty of the natural surroundings make us justly proud of being a factor in her development and our love for the port will never blind us to any new ideas that may be brought forward. In town planning we have a forceful factor that will be of great value in the scientific development of our seaport, and if we "get down" to the subject, and have the requisite enthusiasm we have the materials to work upon which will, ere long, make Vancouver a city second to none in the Empire. In about thirty-six years we have risen from a sleeping village on the foreshore of Burrard Inlet to a city of nearly two hundred thousand souls. A city admired by all visitors from other lands and a place of great attraction to tourists the world over. That is a record to be proud of. Mistakes have been made, we all admit that, but the rapid growth of the city is responsible for nearly all of our shortcomings.

It is rather a pity that Mr. Ewing is so far away, otherwise he would probably have given us a lead and some suggestions as to the application of town planning principles to Vancouver and district. For the sake of discussion the following ideas are submitted.

> The time is now ripe to plan ahead in order to counteract the evil effects that will arise, if the points mentioned in Mr. Ewing's paper are not given serious consideration.
>
> In a very short time Vancouver, as we know it to-day, will surely be the hub of a greater city whose boundaries will have extended south, east and west. With that fact in mind, a comprehensive survey should be made of the whole peninsula of Greater Vancouver and a skeleton development plan prepared showing the main and secondary lines of traffic arteries.
>
> Zone areas should be mapped out for the following classes of property:—(1) Residential property; first, second and third class according to the number of houses per acre decided upon; (2) Commercial and shopping centres; (3) Industrial areas; (4) Unrestricted areas. Such a scheme would, of course, require the whole-hearted and unselfish co-operation of all the adjoining municipalities. This can only be accomplished by earnest and untiring effort on the part of responsible leaders, but it can be done.
>
> A good town planning exhibition and a series of attractive illustrated lectures on some special phase of town planning would go a long way to interest the general public in the principles of city planning.

Just for a moment let us consider the advantages of a comprehensive zoning scheme for Greater Vancouver, by reviewing certain difficulties with which we are confronted in this city, due to the fact that no town planning scheme existed. These difficulties are the result of general changing conditions and cannot be placed at the feet of any particular party.

Somewhere in the neighbourhood of one hundred and sixty-four acres of land at the head of False creek have been reclaimed and the district will become a hive of industry in the future. Out of this area, which is reserved for railway terminal and general industrial purposes, will flow a great volume of traffic. This area is practically a cul-de-sac, surrounded as it is on three sides by high lands which almost prohibit traffic egress. In consequence of this condition most of the traffic will find its way on to Main street, an artery already severely taxed, with the accompanying confusion that may possibly occur. The city engineer has wisely defined a new building line on Main street in the vicinity of this area which will ease conditions in the future, but the situation there is so acute that the question of transportation facilities, for the whole district in the immediate vicinity of the railway terminus, should be reviewed along town planning lines. Under a town planning development scheme the future requirements arising out of a reclamation scheme of this nature would have been fully developed before any negotiations were completed. In all probability the Georgia-Harris viaduct would have found its logical landing on the east side at Prior street to take care of the increased traffic from this new railway centre.

Scattered over the city, industrial establishments are opening up and as time passes the demands for transportation facilities are steadily increasing. These scattered communities are going to mean expensive pavements in the future and great maintenance cost. Under a town planning scheme these areas would be scientifically located and a minimum cost required to feed them with road transportation facilities.

We have also a curious condition to face in the Kitsilano district where the old Indian reserve, of roughly eighty acres, is ear-marked for industrial sites. One wonders what the effect will be on the really good residential property around the fringe of this proposed industrial site.

No doubt our present tax rates would have been considerably reduced if this city had expanded along town planning lines. By the institution of what we might term "development zones", a controlled system of expansion could have been followed along economical lines. These development zones might have been divided into three great heads: (1) An inner circle zone within which full public services would be available, such as reasonably good roads, water-supply, sewerage facilities, light, power etc.; (2) an intermediate zone provided with limited public services; (3) an outer zone which we might refer to as "a pioneer zone".

Such an arrangement would relieve the authorities of the necessity of providing roads and other services in undeveloped areas and would also relieve them of the heavy costs involved in providing facilities that one would only expect in a well established area. A settler would thus know exactly what to expect in the zone in which he decided to locate. The general expansion would thus be from within, and as the city increased in wealth and property, improvements to the outlying areas would develop as a matter of course. A scheme of town planning covering the whole of Greater Vancouver might with advantage include "development zones" along the lines suggested.

The segregation of the oriental population of this sea port is a matter that should receive very careful and immediate consideration and is of vital importance to the formation of that community spirit so essential to the welfare of Vancouver. The importance of public health in only realized by the general masses when an epidemic of disease springs up in our midst. The necessity for town planning will probably only be fully realized when we are faced with expensive reconstructive problems due to the neglect of town planning principles. There is probably no city where municipal engineering problems are being more efficiently handled than in Vancouver. The immediate necessities are well under control, but a greater responsibility rests with all our technical and professional men and healthy citizens. Town planning means looking ahead and our responsibilities run in that direction.

It is a privilege to have had the opportunity of hearing Mr. Ewing's paper. The subject is one in which we are all interested and in the study of which we find much that is wholesome and refreshing.

Irrigation in British Columbia.

A Review of Irrigation in the Province from the Earliest Undertaking to the Present Extensive Systems.

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Compared with some of the older provinces of Canada and with the great western prairie provinces, British Columbia may not be regarded as a province of prime agricultural importance. The generally accepted estimate of 22,600,000 acres as the agricultural area of the province in comparison with 81,300,000 acres of agricultural land in Alberta, for instance, may lend support to such a conclusion. Of this area 3,000,000 acres are occupied and approximately 700,000 acres are under cultivation, in 16,000 holdings of from five acres upwards. The disparity, however, between the available arable acreages in this province and the vast areas of our neighbours to the east and in the adjacent states to the south, is to some extent at least offset by the excellence of the climatic conditions and soil characteristics of some of our valleys, which make them peculiarly adapted to crops of high value and admit of an intensive cultivation and a density of agricultural population not possible in many of the farming districts elsewhere. The relatively limited area of these valleys nevertheless emphasizes the desirability and the necessity of making the very best use of them.

It is not surprising that in the area in which our agricultural lands are found, extending from the 49th parallel to say the 56th — the latitude of Hudson's Hope — and extending westerly from the 114th meridian to say the 130th, covering a range of altitudes from sea level to perhaps 3,500 feet, there should be wide variations in both summer and winter temperatures and in the more important factors of sunlight and precipitation.

Where Irrigation is Required

In localities so arid as to suggest a much more southerly latitude, land has no agricultural value other than that of range land, unless supplied with water for irrigation. The amount of annual precipitation does not alone determine the localities in which irrigation is necessary, for the precipitation during the growing season, humidity, proximity to the sea coast, elevation, soil conditions and kind of crops are important factors. It may be said in general that in those portions of the province where the annual precipitation is less than from sixteen to twenty inches irrigation is always desirable and generally necessary. The following table, showing the mean annual precipitation and the mean during the four months when vegetable growth demands the greatest amount of moisture, indicates that at widely separated points the natural conditions require to be supplemented by irrigation.

PLACE	Average Rainfall during four Summer Months	Average Yearly Rainfall
Victoria	2.86	27.66
Vancouver	8.76	59.06
Agassiz, (Lower Fraser)	13.56	63.78
Quesnel, (Upper Fraser)	6.25	14.78
Kamloops, (Thompson valley)	4.58	10.25
Summerland, (Okanagan valley)	4.53	11.04
Grand Forks, (Kettle valley)	5.95	16.25
Nelson, (Kootenay valley)	8.46	27.03
Invermere, (Columbia valley)	5.85	12.14

The best estimate available of the area now under irrigation in the province is 69,882 acres. This is, at best, an approximation, as the areas under individual operations are widely scattered and the data in respect of them are far from complete.

Legislation Governing use of Water for Irrigation Purposes.

The records of the Lands Department show that the first water right granted for agricultural purposes was under date of October 30th 1858, for the use of water from Nohomeen creek near Lytton. This was in the Crown Colony days and antedated by nearly a year the provisions of the proclamation by Governor Douglas, known as the Goldfields Act 1859, and the rules and regulations thereunder in which the first specific reference to the acquirement of water rights is made. The Act, it may be noted, applied particularly to the use of water in mining. It first enunciated the principle, since maintained throughout all our water legislation, known as the doctrine of beneficial use. From 1860 to 1864 a number of further records were made for agricultural purposes under this Act.

It was not until the enactment of the Land Ordnance in 1865 that distinct provision was made for the diversion and use of waters for agricultural purposes. The subsequent amendments and consolidations of the laws affecting Crown lands carried the water legislation down to the passage of the Water Privileges Act of 1892, which declared the right to the use of all water not at that time recorded and appropriated, except that under the jurisdiction of the Parliament of Canada, to be vested in the Crown in the right of the Province. This Act was followed by the Water Clauses Consolidation Act 1897, and its various amendments designed to meet the needs of the country's development. Owing to certain elements of weakness in the legislation and in view of the great number of records that had been made in the fifty preceding years, many of them imperfect, the Legislature of 1909 created a Board of Investigation with authority to review and define all existing rights and order the issue of licences in respect of them. The Board is a semi-judicial body, exercising wide discretion in the matter of old rights and is charged with many other duties under the Act of 1909 and the Water Act 1914 which, with its amendments, is the code now in force.

It was not until 1908 that particular reference was made in our legislation to the storage of water, although a number of the early records undoubtedly carried storage privileges. In the 1909 Act recognition was first given to the need of a wider use of water for irrigation purposes than that which could be provided by the individual settler and licensees were empowered to combine for the construction of works. In 1913 provision was made for voluntary partnerships, to be known as Water Users Communities, for the purpose of constructing and operating works. More elaborate provisions were made in the Water Act 1914 for other methods of co-operative or corporate enterprises by way of the Mutual Water Company, the Land and Water Company, and Public Irrigation Corporations. Some of the changes, which experience has shown to be desirable in respect of these joint or corporate undertakings, will be referred to later. The 1914 Act also provided for the appointment of district engineers, to whom were assigned certain administrative duties, giving an element of local control in the diversion and use of waters and in the establishment of rotation on streams where the flow is inadequate for the continuous supply of all the licences thereunder.

To the consistent care that has for years been bestowed on Provincial legislation in respect of water may be attributed our comparative freedom from legislation in connection with its use and administration.

In the adjudication of the old irrigation records the Board of Investigation set a general duty of water at two and one-half acre-feet per acre, with reasonable allowance for losses by seepage from point of diversion to place of use. The latter is estimated for each particular case by the engineers of the various water districts in accordance with the data available for the creeks, ditches, flumes and other means of carriage. In certain localities duties as high as one acre-foot per acre and in others as low as three acre-feet per acre are allowed, depending upon the climatic conditions of the place and the nature of the soil and subsoil and upon the character of the crops grown, though the latter are subject to considerable change. Speaking broadly the duty as set had the merit of being generally adequate. The application of twenty-four to thirty inches in depth of water to cultivated ground during an irrigation season varying from ninety to one hundred and twenty days, distributed with care, is found sufficient for the ample production of tree-fruit, root or forage crops, except from the most porous soil or in localities where hot winds prevail during the growing season. It is hoped that studies may soon be undertaken in some of the irrigation districts where facilities for careful measurement of water are being provided, with a view of determining more closely for particular localities, soils and crops and with a fair degree in application, what results may be expected with certain quantities of water.

To those not directly concerned with irrigation the statement that it has been shown experimentally that from 400 pounds to 800 pounds of water is required to mature one pound of the dry vegetable product from certain soils and several times that amount of water for other soils: or that 2½ acre-feet of water per acre means the application of 550 tons of water to each acre during the irrigation season: or that it has been estimated that a forest may transpire more than 2,000 cubic feet, i.e. more than 60 tons of water per acre each day of the vegetative season, will indicate at once the great quantities employed and the importance of having, for our own province, some experimental studies under varying conditions. Increased duty of water resulting from avoidance of waste means generally a greater area that may be supplied from the same source or smaller works for the same area and greater freedom from damage to lower lands due to seepage. The latter problem has already begun to make itself felt in some of our older districts.

Irrigation Difficulties in British Columbia

It is stating a truism to say that the proper use of water for the production of crops requires the application of intelligence and skill. It is equally obvious to one who may visit the various irrigated districts in British Columbia that perhaps in few places where the art is practised has nature offered more challenges to man's ingenuity to secure sufficient water for a season's use, store, carry and distribute it, at a cost within commercial limits.

A consideration of the topographical features of the interior of the province reveals the reasons. Our valleys are very narrow and are occupied generally by rivers which meander from side to side and to expansion into lakes that occupy the valley floors where broad stretches of moderately level lands might be expected. Our irrigable lands are so disposed that it has not been possible to make direct diversion from the lakes for any considerable area of land along the rivers below them. The arable lands about the lakes depend, therefore, for water upon the lateral streams or upon pumping. The latter in general is often restricted by the elevation of the lands and frequently by the absence of cheap power. Owing to the great range in river stages in the interior, the larger areas of lower lands along them are in greater need of drainage than of irrigation, while the bench lands that border the rivers are in most cases too high to permit of direct diversion from them. As a consequence these lands also depend for irrigation upon the waters of lateral streams. The only instances of gravity diversion from the larger rivers so far for any appreciable area is for the Southern Okanagan project, and for the Similkameen Fruitlands. The East Kootenay valley, extending from Canal Flats northward along the Columbia to Golden and southward along the Kootenay to the International boundary, the valley of the Fraser from Quesnel south, and of the South Thompson, afford striking confirmation of some of the above statements.

The rapid run-off of the lateral streams demands that storage shall be provided to supplement the period of low flow. Here again nature has been adverse in that she has allowed of few opportunities of storage between the summit country, in which the streams have their sources, and the valley levels. Small lakes and basin-like depressions and meadows are to be found at or near the heads of many of the streams but their value as storage reservoirs is more frequently limited by the relatively small catchment areas above them, than by the unsuitable nature of the sites at which they may de dammed. The spring run-off from the lateral streams in the Dry Belt would provide water for the irrigation of many times our present area were it possible to find suitable and adequate storage.

The extremely rugged topography of much of the country bordering the streams and the generally broken and rolling nature of the irrigable lands have furnished the physical difficulties to be overcome and have added greatly to the cost.

Nevertheless the pioneers and promoters of the earlier irrigation enterprises went boldly forward with an forming considerable parts of the works or the costs of optimism and energy worthy of so good a cause, but apparently without a due appreciation of many of the factors in the problem, such as: a proper knowledge of the available water-supply from the streams; the wide seasonal variations in stream-flow, and the amount of storage necessary; the increasing requirement of water for maturing orchards and the losses in conveyance, and distribution in earth ditches and wooden flumes; the relatively short life of many of the temporary structures maintenance and operation. The works were generally constructed of wood and were of a temporary nature; and the low costs of labour and materials allowed of the works being constructed as cheaply as possible. All things considered the materials and types of construction generally were the most appropriate for the time and stage of development. The failure of many of the enterprises was not attributable alone to the factors mentioned but in some measure to other contributing causes. Had the enterprising pioneers of corporate irrigation undertakings in this province foreseen all the conditions there would have been fewer failures, but irrigation agriculture in British Columbia would to-day be far behind its present development.

Early Operations of Land and Water Companies

The first instance in the province of sales of small tracts of irrigated orchard lands was in 1893 under the system from Coldstream creek near Vernon, on which there was a water record granted as early as 1868. This was due to the enterprise of the Earl of Aberdeen, and established the value of irrigation in that district which has since become one of the most beautiful and productive areas in the province. Following the Coldstream venture, which preceded by several years any similar effort, large tracts of land throughout the Dry Belt were acquired and companies formed for the purpose of developing and selling small holdings.

There were several variations in the methods in general use under which companies conducted their operations. An ordinary way was for the "land company" to acquire water rights which were made appurtenant to the lands and under the law became inseparable from them in that they passed automatically with any transfer, sale or other disposition of the lands. The company became what was commonly known as a "Land and Water Company" and sold its lands subject to an agreement under which it undertook, in consideration of an annual rate per acre payable by the purchaser, to supply, convey and distribute the water. The logical sequence of this form of conduct was that when the company sold all its lands, its particular interest in the project would cease and the purchasers would then require to make such arrangements as would be necessary for continuing the operation of the system. It so happened that the companies were unable to sell all the lands and in those instances where the companies did not either directly or indirectly cultivate considerable areas they were themselves later emmeshed in the general distress that surrounded the purchasers.

In order to correct one of the obvious defects of this plan and to ensure to the purchaser an actual interest in the works and a consequent responsibility toward their

upkeep, land companies in one or more instances created subsidiary water companies whose business it was to construct the irrigation system and carry and distribute the water. The share capital of the water company was made equal to the number of acres it was proposed to irrigate and as the lands were sold an equity in the system, by way of shares proportionate to the number of acres sold, was transferred to the purchasers.

More commonly the land company created its subsidiary water company without any relation between the share capital or number of shares and the acreage held by the parent company, with no provision for the transfer of water shares with the land as in the case just referred to. The water company constructed and operated the works and the lands were sold subject to an agreement with it for the supply of water at a rate per acre or per acre-foot. Money for construction was generally provided by the sale of bonds. The land company's chief interest naturally lay in seeing its lands sold at satisfactory prices. The water company was left to maintain and operate its works and supplying the user with water.

The unsold lands of the parent companies, except in special instances where cultivated, paid no rates to the water companies, consequently the income was derived solely from the water user and was insufficient for their actual needs, maintenance was sadly neglected, many of the systems gradually fell into disrepair; no sinking funds were set aside for future restorations and reconstruction; and in some of the more important instances the bond holders were obliged to apply to the Courts for the appointment of Receivers who operated the systems as best they could.

The rate per acre payable under the several water agreements varied considerably. With the exception of the first agreements made by Lord Aberdeen with his users under which the rate was thirty cents per irrigable acre per year, the general range was from $1.50 to $5.00. In one case an annual rate of $4.00 per acre per year, toward the general maintenance of the works, was made, together with a charge for the conveyance of the water not to exceed $8.00 per acre-foot. A general acceptance of such charges might have hampered development but would have represented a much nearer approximation to the actual costs.

The quantities of water which the companies undertook to deliver varied. In one instance it was the proportion of water from time to time passing through the main ditch that the irrigable area of the user bore to the irrigable area under the system. Again it was the water available to the company divided in the ratio of the area of the user's lot to the total area of the lands to which the record was appurtenant but not to exceed in any period of three and one-half days a greater quantity than one quarter of an acre-foot per acre.

It is interesting to note that, prior to the year 1906, four land companies were incorporated for the purpose of dealing in irrigated lands. Up to this period no separate water companies had been formed. In the succeeding years, to and including 1912, fifty-six land companies and eighteen water companies were incorporated. Of these there are to-day remaining in an active state ten of the former and two of the latter. Of the ten operating land companies three or four appear to be functioning with greater or less degree of anxiety and the remainder are existing with great difficulty. Systems constructed by two of the companies, *viz.* Southern Okanagan Land Company and Summerland Development Company, were purchased and are operated by the municipalities of Penticton and Summerland, respectively.

Provincial Legislation to Provide Assistance

As already intimated a period of distress was bound to arrive. Appeals for assistance were made to the provincial government. Legislation in 1917 provided drastic methods of dealing with cases where a company failed to carry out necessary works, under the provisions of which authority was given for an order by the Lieutenant-Governor in Council declaring the appurtenancy of the works to the lands they were intended to serve. This authority has been invoked only in two instances.

A more beneficent piece of legislation was that of 1918 which made provision for the creation of a Conservation Fund to be administered by the Lieutenant-Governor in Council on the recommendation of the Minister of Lands from which necessary financial assistance might be given in approved cases, either by direct expenditure or by way of loan. The expenditures to date have been approximately one and three quarter million dollars. The duties of investigation, report, and supervision have fallen upon the Water Rights Branch of the Department of Lands.

Immediate aid was given in several cases to keep the systems in a condition to carry water and in 1919 extensive studies were undertaken to increase our knowledge of the water resources of the summit country on either side of the Okanagan valley. It was in this valley that help was most urgently required. A classification of the lands under or adjacent to the various systems was made so that a determination could be arrived at of the areas that might be supplied both now and in the future from the sources under consideration. Examinations were also made of the general condition of the works.

Results of Investigation upon which Government's Policy was based.

A careful study of the economic aspects of the situation revealed a maze of physical, financial and legal difficulties that led to certain conclusions on which the government's policy was based.

Firstly: The works must be acquired by the land owners and water users under them and their complete separation from companies, bond holders and shareholders effected.

Secondly: The money required for the purchase, restoration and extensions of the works must be obtained through governmental agency.

Either the guarantee of bonds by the government or direct loans from the Conservation Fund were indicated. Bonds without guarantee would be unsaleable. Guaranteed bonds would place the liability on the province, but would not be expected to sell at as high a price as provincial debentures. The burden of the users would in general be heavy for it was manifest that they had in many cases purchased their lands at prices which might reasonably be held to include a pro rata share of the system, in which they had, however, no legal interest. They were now faced with the problem of borrowing money to purchase the depreciated works and to provide for renewals.

Costs of construction due to abnormal prices of labour and material would be heavy so that it appeared necessary to lighten the financial load as mush as possible. The most effective way of reducing the interest burden appeared to be by making the Conservation Fund a slowly revolving fund and handling the problem by loans therefrom. Raised on the general credit of the province and loaned at a rate that approximates the cost of money to the province it afforded the method selected.

Thirdly: Legislation of as simple and practical a nature as possible must be provided under which appropriate areas could be formed into irrigation districts. The districts to be formed to include all the lands which the constructed systems and necessary extensions of them could carry where a sufficient water supply was or could be made available.

Fourthly: In order to more equitably distribute the burden and to promote production every acre of irrigable and arable land included in a district, whether using water or not, would be required to pay a proportion of the capital charges in respect of it.

Fifthly: Repayment of moneys borrowed would be made in annual instalments with interest and would be computed on a consideration of the probable lives of the various structures in which it would be expended so that by the end of the useful life of a structure all sums borrowed in respect of it would have been paid.

The districts where the necessity of assistance was greatest were the first to receive it. All matters affecting the various questions at issue were discussed with committees of water users and the negotiations for the purchase and transfer of the numerous rights and interests in the systems were undertaken. Concurrently repairs and renewals were vigourously carried on. Additional storage was created and extensions to the works put in land. Legislation was prepared and passed at the session of 1920.

Irrigation Districts Established

At the end of the year six irrigation districts were incorporated by Letters Patent and the systems transferred to them. Since that date others have been formed and consideration is being given to the petitions for several more. The Letters Patent may be considered as the constitution of the district since they define its particular powers and obligations and set out the special provisions applicable to it.

It will be observed that the districts are borrowing concerns and that they have complete ownership of the works that serve them, subject to the first charge by the Crown in respect of all moneys expended on them from the Conservation Fund. Control of the district affairs is placed in the hands of the trustees elected by the users at large for periods of one, two and three years. The lands are graded by an assessor and the roll revised by a Court of Revision. Taxes for the primary purpose of making repayments to the Conservation Fund are levied pursuant to by-laws and tolls for the use of water and for administration purposes are set in accordance with the needs shown by the district's budget. Taxes if unpaid become in arrears at the end of the first year, are delinquent at the end of the second year after which the property may be offered at tax sale. With one or two district exceptions water is not supplied if tolls for the preceding year remain unpaid. A uniform system of accounts is used so that expenditures on certain classes of works and other items are comparable. The users have the opportunity of expressing themselves fully at an annual meeting at which a financial statement is presented and the trustees give an account of their stewardship.

Taxes differ considerably in the several districts and vary according to the capital costs per acre and the grade of land, from $2.45 to $15.00 per acre for first grade lands. Tolls are based on different conceptions of the trustees as to how water should be charged for in order to meet maintenance and administrative charges and according to the circumstances attending the supply and use in the particular district. A minimum toll entitling the user to one acre-foot with an additional charge or charges for all water in excess or a charge per acre-foot for water used before a certain time, i.e. before storage water is required and a higher unit rate for later water is not uncommon. Tolls in the different districts vary from $1.00 to $6.75 per acre per year.

The fact must not be lost sight of that the greatly increased annual per-acre cost of water to the user has been brought about by the adversities already referred to that have attended the growth of the industry.

The necessity of borrowing to meet the large expenditures for the purchase and rehabilitation by the users of systems that did duty from the time of their installation with little maintenance and no provision for renewal, imposes an interest charge that must be carried. The inherent high costs of irrigation construction in a rugged country and in times of abnormal costs has also added its quota. The districts now operating are given in the following table.

Irrigation District	Location	Irrigable Area in Acres
Vernon	26,000 acres surrounding the city of Vernon	14,130*
Glenmore	North-east of Kelowna	2,565
Black Mountain	East of Kelowna (a block of 11,028 acres)	4,607
South East Kelowna	South-east of Kelowna	5,433
Scotty Creek	North-east of Kelowna	1,000
Peachland	At Peachland on west side of Okanagan lake	700
Naramata	About the village of Naramata; near end of Okanagan lake	1,050
Westbank	Slightly south of Kelowna; west side of Okanagan lake	1,200
Kaleden	At Kaleden in Okanagan district.	
Grand Forks	Adjoining town of Grand Forks	4,150

*Estimated

In the above table are listed the names of the irrigation districts now in operation which were described in detail by the author.

Among the smaller districts incorporated within the last two years are Malcolm Horie District near Cranbrook, Canyon Creek and Erickson near Creston, and Heffley Creek and Vinsulla on the North Thompson river, tributary to Kamloops.

The number of incorporations to date under the several forms of control are:

Irrigation Districts under the Water Act	11
Irrigation Districts under the Drainage, Dyking and Development Act	3
Water Users Communities	8

In view of the experience under the 1920 amendments to the Water Act pertaining to districts it seems probable that with the exception of the smaller communities the organizations will gradually be changed to bring them under its provisions.

Among the companies still operating are the:

Okanagan Valley Land Company, supplying 2,000 acres at Okanagan Centre and with an additional 1000 or more acres yet to develop. Its water supply is taken from Vernon creek.

Woods Lake Water Company on the lake formerly known by that name. An area of 800 acres is well developed, the company having been formed in 1907.

Long Lake irrigation Company with an area of 800 acres lying on the west side of Long lake at Oyama.

The Keremeos Land Company occupies the Similkameen valley immediately south of Keremeos; 1,050 acres under the system being in cultivation while the water supply from Ashnola creek is adequate for 1,000 acres of additional lands.

Similkameen Fruit Lands Company, operates just below the Keremeos Land Company drawing its supply from the Similkameen river at Cawston. It has several hundred acres under its ditches and proposes to pump for an increased area.

B.C. Fruitlands Company at Kamloops, was among the early companies. It has been irrigating a considerable acreage of its own lands, much of which it has under lease.

Columbia Valley Irrigated Fruitlands. Extensive systems were constructed in 1910 to 1912 for the irrigation of 14,000 acres of land in the Invermere section of East Kootenay District but development has been slow.

Municipally owned and controlled systems are those of Penticton and Summerland already referred to. The areas under each are well developed and important producers.

The only project undertaken directly by the Government is that in Southern Okanagan extending along Okanagan river from a point about two miles below Vaseau lake to the International boundary. The water is taken directly from Okanagan river by means of a concrete diversion dam and is carried in a concrete lined canal for about seven miles and conveyed by a seventy-eight-inch wood stave and an eighty-inch steel inverted syphon to the west side of the valley and from thence to the southerly end of the project. When completed the main canal will be twenty-one miles in length. Pumping is resorted to for areas above the canal. Approximately 12,000 acres will be irrigated of which approximately 1,300 acres are being irrigated this year.

No reference has been made to the numerous individual and small community irrigation works throughout the interior. In the aggregate they are of great importance and have added their quota to our annual crop production and their valuable experience to the general fund.

Tribute must be paid to the excellent work done by many of the early engineers who pioneered construction of irrigation works in this province, among them the late Chas. A. Stoess; A. E. Ashcroft of Vernon; F. W. Groves of Kelowna; and F. H. Latimer of Penticton.

It is not proposed to discuss in a general paper such as this the engineering features of the works referred to. They are of the types of design and construction generally used for their respective purposes and represent few unique features. Open ditches and wooden flumes are, of course, widely used, though much concrete lining varying in thickness from two to four inches and some gunite lining, has been done of late. Metal flumes have been, and are being, extensively used. It is too early to give even a general statement of their length of life under the varying condition of use. Some of them have been in place for eleven years and are still in good condition. They have not had very fair treatment for in most cases no care by way of applications of tar, asphaltum or other preservative has been given them. On the other hand there are many instances of wooden flumes having given ten to fifteen years' service and still carrying water, though becoming generally decrepit. The maintenance charges must have been heavy but it cannot be denied that wood flumes still have a place in irrigation works in a new country.

The semi-circular wood-stave flume has not had the use its merits would appear to justify. The use of pressure creosoted lumber should make it a fair competitor of the metal for localities where transportation costs are light and leakage in the spring not important, though the greatly decreased costs of metal of late may offset the advantages. The newer zinc flumes have, so far as the writer knows, not yet been used in the province.

During the interval since the first projects began operations, much has been gained; the land has shown what it will do; the adaptability of various localities to the growth of particular crops — fruit, roots, cereals or forage — has been demonstrated, the varieties of fruits most suitable to each locality and the merits and demerits of intercrops or two-storied farming have been pretty well determined; the means and methods of combatting the insistent pests have been improved; the necessity of fertilizing by the keeping of live stock, the rotation of crops such as alfalfa and root crops or the use of commercial fertilizers has become apparent. Experience has shown where the relatively few frosts pockets are located in the areas under the ditches. Costs of production have been studied and the advantages and defects of co-operative and other forms of handling and marketing the crops have been experienced and debated. Much light has been thrown upon the suitability of the various classes of works to meet unusual local conditions and the probable useful life of the structures involved; while much valuable information of many related matters has been acquired.

Most valuable of all is the experience and skill of the large number of farmers and orchardists on these irrigated lands who have gained their knowledge of the complexities of this branch of husbandry through the hard knocks of personal experience — an experience that forms a most substantial foundation for progressive development of irrigation in the province.

If in the future some of the errors may be avoided that have in the past made the way difficult and some additional attention be given to those breaking ground in new projects, there appears to be no doubt but that the industry will afford the most ample justification for the confidence of those who pioneered it and for the pledge of public credit that has come to its rescue.

Discussion on Irrigation in British Columbia

P. J. Jennings, M.E.I.C.,

Acting Assistant Commissioner of Irrigation for Alberta and Saskatchewan.

The speaker has dealth with; (1) the history of irrigation in British Columbia from the date of the first grant, (2) the result of a want of foresight in the early administration of, or, rather the lack of any legislation dealing with water administration, (3) the errors and complications which resulted therefrom and the methods and subsequent legislation necessitated to correct same.

A word of praise is undoubtedly due to those who have been responsible during the past ten years for the administration of the Water Rights Branch and for the success they have undoubtedly achieved in straightening out many very complicated tangles of a semi-legal, semi-engineering character. As a result of their efforts the Province of British Columbia has now been placed on a sound and business like footing as regards its water rights.

Fortunately, for the future of our water resources, we in Alberta and Saskatchewan, are more fortunate in regard to the laws governing its diversion and use. With great foresight and possibly influenced by the unfortunate experiences of the western states, the framers of the Federal Irrigation Act, provided that a limit should be placed upon the quantity of water that might be appropriated for use per irrigable acre. This quantity was at first fixed at two acre-feet for each irrigation season, to be measured at the point of delivery of any farm unit, and was at the time considered sufficient for the average crop, and requirements in these arid sections. This quantity was therefore established as the "legal duty of water." After a few years of experience it became apparent that this was an excessive quantity to apply to most crops and the department after making a careful study of conditions and carrying out experiments in several sections of the province increased the duty to one and a half acre-feet per acre. That is to say the duty or work that a unit quantity of water is required to do was increased.

Where such extreme conditions as to area and available water supply, as we have east of the Rockies, exist, i.e., only about ten percent or five million acres of the area that should be irrigated, can be irrigated, you will realize very readily the enormous value of any experimental work which would tend to a more economical use of water. Our investigations have proven that under similar conditions this "duty" or volume of water that is required to mature a crop on an acre of land, remains fairly constant for the same crop, but varies widely for different crops, soils and climates. If then this valuable information, the result of years of study and experiment, could be given to every irrigator in a form that he could understand, a great saving of water would result, but he must first realize that he will receive an increased production from a scientific rather than a haphazard use of water.

We have collected a lot of data regarding the results of nine years of experiment station work at our Brooks farm and this has been written up in language that can be readily understood by the farmer and will be published at an early date. It has been generously illustrated and every conceivable implement required for irrigation farming on the prairie has been depicted and explained.

Professional Engineering in the British Columbia Logging Industry

Primitive Logging and the Development of Modern Scientific Methods.

T. W. Fairhurst, A.M.E.I.C.

Sales Engineer, Vancouver Machinery Depot, Limited.

Paper read before the British Columbia Professional Meeting of The Engineering Institute of Canada Vancouver, B.C., June 16th, 1922.

The remarkable advances made in recent years in the magnitude of logging operations in British Columbia have been coincident with the increasing use of professional engineering services in the woods, and the further scientific development of this primary natural industry of the Province is now dependent entirely upon the services of professional engineers, both civil and mechanical, as well as the newly developed forestry engineer who is intended to be a judiciously specialized combination of both.

Historical References to Primitive Hand Logging

Thirty years ago, in the very early days of logging, the operation was extremely primitive. Only timber actually on tide water was selected for cutting, owing to the ease with which it could be dropped into salt-water for towage to mills. This simple programme was carried out mainly by hand logging, the only appliances necessary being the hand cutting tools and a selection of jacks which, attached to stumps or trees, were used to shift the logs about.

Skid roads were laid to tide water without any attempt at economical location, other than picking out an easy path with the eye, and down these skid roads the logs were slid with the aid, in some cases, of horse or bull teams. This method of production was very slow and limited, but comparatively cheap.

Some few years later enterprising operators, who were by this time getting quite a few hundred feet in-shore from tide water, began the use of primitive mechanical aids, such as the single drum horizontal steam spools, supplied with steam from small low pressure wood fired boilers; the haulback, or return line, being hauled out for a new load by a horse. This was a slight improvement over purely hand logging and was quickly followed by improved machinery which in a very few years had developed as far as the simple yarding engine with main-line and haulback drums, and supplied by a properly designed boiler, all mounted on braced timber skids, and capable of being moved by its own power to fresh locations as required. Logs yarded to a central point by this means were sent down to tide water by means of simple roading engines handling the long haul to the sea by pulling or lowering trains of logs down the previously described roughly located skid roads.

Advent of the Railroad as an Aid to Log-transportation

Following closely on this phase came the railroad. Sea-shore limits became rapidly exhausted; the logger was now boring inland and was beginning to measure his haul to tide water in miles instead of feet. Here begins the advent of the civil engineer into the logging industry. Having yarded the logs to a central point the operator was faced with haulage to the sea. The old eye-sight method of road location was no longer feasible and the engineer proper was called in and the railroad was located and built. In the early days this was of very light construction, probably not more than thirty-pound rails being used, and, in order to accommodate the capacity of the ten- to twenty-ton straight connected locomotives then in use, no grade over three percent could be allowed.

On the heels of the last phase came the geared locomotive, capable of handling grades up to eight percent, and thus shorter cuts to any given point were made possible and logging locations hitherto inaccessable were rendered accessable.

The advent of railroad operation resulted in yet another new departure, the steam loading donkey. Throughout the days of skidding operations no special bodily lifting of the logs had been necessary, but to load the centrally yarded logs on cars necessitated the adoption of other means. Accordingly the crotch line loading system was introduced, consisting of a single line working through a tree-mounted block, but forked out to hooked points so as to grab each end of the log; the single line being worked by attachment to a loading drum on the yarding engine or by a separate simple loading engine.

Intensive Mechanical Development

Here begins a long period of intensive development of the mechanical aids to log-getting; a fierce period of technical competition during which the ingenuity and resource of the mechanical engineering designer has been taxed to the utmost, until to-day no location is impossible of operation.

First in this period came the two-speed yarder with high speed on low power for straight unobstructed hills and, per contra, lower speed with higher power for worrying the logs out of obstacles. This class of engine resulted in the getting of more logs per day than the simple loading engine could handle. Accordingly the duplex loading engine was brought in; this machine having two sets of engines, instead of one, handled the log with one engine acting on each end, each engine having its own line, each log therefore being loaded just twice as quickly as by the simple engine, which latter had to have its logs swung and adjusted by hand.

Then came the aerial skidders with enormously powerful engines by which the logs were brought in on air lines instead of being yarded along the ground by the old method, which often resulted in serious damage to logs through bucking ground obstacles. Larger duplex loading engines were required and brought into use, with the result that, instead of the old fashioned donkey of twenty-five years ago reaching out for about 1,000 feet and getting in perhaps 30,000 feet a day, we have the complicated monster of to-day reaching out to 4,000 feet, by aerial lines, and getting anything up to 200,000 feet a day.

Even the braking on these modern engines has now got beyond the powers of the hand-brake, the steam friction and dogs, and air brakes of the locomotive type are now found on the most modern engines.

The aforementioned period of strenuous mechanical competition has also brought in modern air-brake lowering engines, the compounding and duplicating of steam cylinders, and boiler pressures up to 200 pounds, with the result that some of the modern steam logging plants weigh upwards to one hundred tons and arem ounted on all-steel railroad cars for transport, as against the old time ten-ton donkey on its primitive wooden sled.

Development of Heavy Geared Locomotives

Locomotive work has also developed out of all recognition as compared with old time methods. In British Columbia alone there are a score of operators owning railroads. Weights of locomotives have increased until, to-day, geared logging locomotives, in many cases, weigh up to ninety tons and are capable of handling loads on grades to eight percent with as much ease as in the case of the same loads handled on level road beds by straight connected locomotives.

Increasing Need of the Civil Engineer

Now to turn again to the civil engineering aspect of intensive logging as carried on to-day. Operations are constantly increasing in magnitude; ground and settings are now being surveyed with real technical accuracy, instead of by rule of thumb; and most large operators have found that, in order to obtain their product economically, it is imperative that they use the services of a thoroughly competent engineer whose duties are to exploit any particular location or setting, to its highest economical possibilities, along lines such as: — (a) Run-

ning in railroad in the most economical manner, with due regard to cheapness of road construction. (b) Choice of easiest and shortest grade, with regard to economy in subsequent haulage. (c) Location of central yarding point so as to save steam and spare mechanical equipment.

Some large operators are now inland as much as twenty miles. In these cases their last six or seven miles are probably actual heavy grade logging railroad in the timber, whereas there may possibly be some dozen or more miles of mainline from their base camp down to tide water where logs are boomed. These railroads, to-day, are by no means rough and ready, temporary roads. They are 50-pound construction, or better, and are fully and properly ballasted. All curves are run and banked as perfectly as on a mainline trans-continental road. It will therefore be readily seen that this thoroughness and accuracy demands the highest class of construction and supervision.

Power Equipment on Right-of-way Construction

Instead of the hand methods of years ago, we now find the most powerful modern mechanical grading equipment used in the construction of this railroad, consisting of steam and other power shovels and ballast unloaders which form the modern and economical development of the old time methods. This constitutes another sphere in which the advance of mechanical science has served to ease the path of the construction man. Many of these shovels are handling 2,000 cubic yards of material per day, and the road is being constructed at approximately twelve times the speed that was the case in days gone by.

The Logging Engineer

With regard to the engineering future of the logging industry, logging is becoming, or rather, has become comparatively an exact science. Accordingly the United States universities instituted, and we are following closely on this idea, courses designed to evolve a more or less new kind of specialized engineer, who shall be sufficiently instructed mechanically to appreciate and operate, with proper care and economy, the highly modern mechanical equipment used in the woods to-day; he shall also be trained sufficiently as a civil engineer to lay out, operate and maintain main-line, branch and mountain railroad, and he shall, in addition to both these qualifications, be especially intensively trained in forestry. A man of the foregoing calibre sounds almost a super-human proposition, but there seems no doubt that the way the various universities are handling the situation men will be produced whose subsequent efforts will extract from the country the treasure of her raw material, whilst their technical ability will prevent the shameful destruction which is always the penalty of rule-of-thumb methods.

Modern Methods Developed to Avoid Destruction of Standing Timber

This last named aspect is one which in its past was badly mismanaged. In order to log out of any given limits the timber which was considered by the logger big enough to be worth while, a vast amount of immature and smaller timber was smashed beyond use in the process.

With modern mechanical means of to-day, especially with the overhead aerial systems, it is possible to pick timber from any location and yard it into a central point, without touching any of the surrounding timber. In this way, for instance, the smaller hemlock may be taken aerially out of any given limits, leaving the large stand of fir and cedar to be taken subsequently, when the falling of it would incur no damage to the smaller timber. It is emphasized that this saving has only been rendered possible by the judgment of the civil engineer, aided by the resources of the mechanical designer. In such ways as these is professional engineering rendering the country immense service and providing an ever increasing degree of all round economy.

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Professional Meeting 1922
Winnipeg: September fifth, sixth and seventh.

Winnipeg in September

Although the official programme of the Winnipeg meeting is not yet available the details are practically completed, sufficiently so to be able to announce that it will be one of outstanding interest to all members of *The Institute*, and as such, deserves the attendance of every member who can possibly be in Winnipeg at that time.

Arrangements are under way for convention rates which will lessen the cost of travel, which, combined with the assurance of a good programme and attractive social functions, should decide many, who have not already definitely made up their minds, to plan to be in Winnipeg on September 5th, 6th and 7th.

Appreciation of the Engineer

It is not often that the engineering profession receives a tribute and there are few records to show an appreciation of what the engineer is, what he is doing, and what are his possibilities, to compare with that offered by Doctor Frank Crane in a recent issue of "The American City". It is hoped that every member of the profession will read this and while the modesty of the average engineer will forbid it, it affords material for conversation with those not in the profession, and for newspaper publicity, in order that the average man may know better what is owing by him to the engineer. Doctor Frank Crane, whose reputation as a philosopher is growing yearly, says:

"The man of the future will be the engineer.

He is the man who can do things; and is better than the man who owns things.

But the official who will forever be indispensable is the engineer.

The time will come when the President of the United States will be chosen as the man who has the greatest talent and skill in organizing public works. There will be no more politics in his selection than there is now in choosing the master mechanic of a railway or factory.

When a nation goes to war nowadays, that is, when it becomes necessary to exert its supreme collective strength, nobody dreams of selecting the most popular politician or the cleverest speechmaker to lead the armies. It is the man who can get the last ounce of efficiency out of men and metal that is wanted.

Some day the nation will realize that it is continually in a crisis, and that in peace as in war we need the highest order of efficiency and organization.

We need the engineer to arrange the transportation of people and goods from place to place, without waste, without competition, without graft, looking only to the public good.

We need the engineer to get meat, bread, and milk from farm to citizen, without the present inefficient tangle of trusts and middlemen working at cross purposes.

We need the engineer to turn the profit of public enterprise toward building good roads and bridges, instead of enriching a few shrewd manipulators.

We need the engineer to manage a city as economically and smoothly as if it were a manufacturing plant.

We need the engineer to organize the farmers so that all can work together for each and their products be marketed without being preyed upon at every step of the way from farm to household.

Wealth can be taken away from us. But the power to do things cannot be taken away.

The millionaire could go and not be missed. The engineers we cannot spare.

'What availeth all thy wealth?' said the ancient philosopher. 'He that hath better iron than thou will come and take away all thy gold.'

Says H. L. Gantt:

'The man who knows what to do and how to do it is preeminently the engineer. The new world which is being ushered in by the great struggle now taking place is one in which the engineer is destined to be the supreme power, for it is becoming clear that, in future, the man who *owns things* will not be as important a factor in the world as the man *who can do things*'."

Reading this panegyric should give a man an added pride in his profession. But that is not sufficient. This is the information that engineers should keep constantly before those in high places, in order that we may not have again conditions as have existed recently. We know thoroughly trained and capable engineers who have been unable to find positions when the country stands in need of the production their training and experience can effect for the benefit of the country. Too long the engineer has been overly modest and to-day the whole profession is suffering as a consequence. Undue modesty is a curse which has reacted heavily upon the position and standing of engineers.

If the lesson has not been learned, the outlook is not promising, but if we have learned our lesson it is obvious that we should on every possible occasion do a little shouting on behalf of the profession in order that the world at large may really know what engineers have done and are doing, and of the super-important position they occupy in the development of a country such as this, which at the present time is not even in the slightest degree recognized, as was pointed out at the recent meeting in Vancouver.

Legislation in Ontario

Affecting as it does a large percentage of the engineering profession in Canada, the legislation situation in Ontario is of more than passing interest. Following the passing of the Act on June 5th, the chairman of the Advisory Conference Committee, Willis Chipman, M.E.I.C., has prepared a report submitted to his fellow members on the committee, and the secretary, F. R. Ewart, M.E.I.C., has written to the various bodies represented on the committee. The report of the chairman contains a history of the movement in Ontario and is as follows:—

Gentlemen:—

The Act respecting Professional Engineers received its third reading, after a long and tempestuous passage, on June 5th. The Act as passed, however, differs materially from the Bill presented to the House in 1921, and re-introduced in 1922.

There was apparently no organized opposition in the House to our Bill, but it was evident when the Bill was introduced for third reading on May 10th, that a number of influential men in the House would oppose it unless it were amended.

The amendments made by the Special Committee on May 16th seriously weakened the Bill, but left it a workable measure that would have undoubtedly given satisfaction to the professional engineers in the province. It was only during the consideration of the revised Bill that those who opposed it succeeded in reducing the Bill to a registration measure similar to that now in force in the province of Alberta.

For your information, I consider it advisable to present a summarized history of the Bill respecting professional engineering in this province from its inception in 1919 to date.

At the annual meeting of *The Engineering Institute of Canada* in Ottawa on Feb. 12th, 1919, a resolution was passed providing for the formation of a Special Committee composed of one delegate to be appointed by each Branch to consider the question of legislation. This committee met on April 5th, 1919, in Montreal. Every Branch in the Dominion was represented. At the first meeting of the committee it was decided that legislation for professional engineers should be sufficiently broad to include all branches of engineering. Upon this fundamental principle the committee proceeded to draft a model Bill, and at the end of the session, which extended over a peirod of five days, this Bill was completed and a printed copy sent to each member of the E.I.C., with a ballot, which resulted in the approval of the general principles of the Bill.

Although a Dominion-wide Bill would have been preferable, we were advised by high legal authority that this could not be done as legislation of this character was controlled by the provinces.

The model Bill drawn up by the committee was published in *The Journal* of *The Engineering Institute of Canada* in May 1919.

At a meeting of the executive committee of the Ontario Provincial Division of the E.I.C., held in Toronto on November 22nd, 1919, the constitution of an Advisory Conference Committee of representatives of other technical organizations was approved and invitations were extended to the following:—

(1) Canadian Mining Institute,
(2) Canadian Society of Chemical Industry,
(3) American Society of Mechanical Engineers, Ontario Branch,
(4) American Institute of Electrical Engineers, Ontario Branch,
(5) Ontario Association of Architects,
(6) Association of Ontario Land Surveyors.

These organizations accepted the invitation and appointed delegates.

The first meeting of the Advisory Conference Committee was held on March 13th, 1920, and during the year eight meetings were held, the last being on Dec. 8th.

As a result of the deliberations of the Advisory Conference Committee, a Bill was drafted which received the unanimous approval of the committee. It should be mentioned, however, that the architects withdrew from the committee in November, as they had decided to ask for separate legislation for the profession of architecture.

The Bill as amended differed in many details from the draft Bill prepared by the E.I.C. Special Committee in April, but the fundamental principles remained. The Bill as adopted by the Advisory Conference Committee was printed in the Canadian Engineer in the issue of Dec. 23rd, 1920, and was thus made public.

During the early months of 1920, Bills respecting professional engineers based upon the model Bill of the E.I.C., were introduced in the provinces of British Columbia, Alberta, Saskatchewan, Manitoba, New Brunswick and Nova Scotia, and a Bill amending the existing legislation in the province of Quebec. In all of these provinces, excepting Saskatchewan, the Bills were passed.

In January and February 1921 the Advisory Conference Committee sent to the various organizations represented by its membership, the Bill as approved in December, with the request that it be approved by the individual organizations in order that it might be presented to the Legislature at the forthcoming session.

Some of the organizations endorsed the Bill in January, but others not until the latter part of February.

After a conference with Premier Drury on Feb. 17th, it was decided to print the Bill, and send a copy to each Member of the House with a memorandum or report. This was done on March 8th and about the same date Col. A. W. Gray was requested to take charge of the Bill.

On April 6th, 1921, the Bill was given its first reading in the House, the number of the Bill being 208. On April 20th it received its second reading and was referred to a Special Committee of the House comprising nine Members. We then expected, in our innocence, that the Bill would be discussed and disposed of before the House adjourned.

On the morning of April 27th, however, the Government decided to adjourn the House within two or three days and we were advised that it would be necessary to leave our Bill over until the next session, and that in the meantime the Special Committee appointed by the House would consider it and it could be introduced early in the next session.

To meet certain objections to the Bill received from time to time after the House adjourned on April 29th, 1921, a number of minor amendments were drafted by the Advisory Conference Committee for presentation to the Special House Committee.

During November and December 1921 the Canadian Institute of Mining and Metallurgy issued a circular to the Ontario members of their organization accompanied by a printed copy of Bill No. 208 and a ballot. It would appear, however, that very few of their members voted, and the results were not published.

The Special Committee of the House appointed to consider Bill No. 208 met for the first time on Jan. 13th, 1922. After sitting in camera in the forenoon representatives of the Advisory Conference Committee were invited to attend at the House in the afternoon. We had before us Bill No. 208 as printed. We were informed that the Special Committee of the House had in the morning approved of the principles of the Bill and they then proceeded to consider it clause by clause. A number of minor changes were made, the most important being the excepting clauses inserted to meet objections that had been raised.

We understood that the Bill was approved by the committee and that it would be introduced in the House early in the session. We afterwards learned that the Bill was reconsidered by the House Committee on Feb. 1st, when they decided to exempt all mining operations from the provisions of the Bill in deference to the Ontario Mining Association.

The House met on Feb. 14th. The Bill was reprinted as No. 67 with the amendments approved by the House Committee and was placed on the order paper on March 22nd, but did not come up for third reading until May 10th. In the House no serious objections were made to the first seventeen clauses of the Bill. Some Members, however, objected to clause 34; the intervening clauses 18 to 31 not being discussed. The House decided to refer the Bill back to the Special Committee, adding to the committee several members.

The new Special Committee met on May 16th, at which meeting clauses 34 (a) and 34 (b) were struck out, and we understood that it was approved and would be reprinted and again sent to the House.

On May 19th it was referred to the law clerk, who made several verbal changes in the Bill, the most important being the deletion of the following words in clause 43 — "respecting the practice of professional engineering or." He also decided that, as 34(a) and 34(b) had been struck out, clauses 44, 45, 46 and 47 were unnecessary and they were then struck out.

With these revisions the Bill was brought up in the House again by Col. Gray on May 29th. It was then ordered reprinted.

The revised Bill No. 67 was re-introduced on June 5th, and after further mutilation was given its third reading.

The following changes were made:—

Clause 2 — the following words deleted — "unless the context otherwise requires" and "expression."

Clause 34 — Revised to read as follows:—

"Any person in the Province of Ontario who, not being regis-"tered as a member of the association in the Province of "Ontario, or licensed by the association.

"(a) Uses verbally or otherwise the title of professional "engineer, or makes use of any addition to or abbreviation "of such title, or of any words, name or designation that will "lead to the belief that he is a professional engineer or a mem-"ber of the association.

"(b) Advertises or holds himself out in any way or by any "means as a member of the association.

"(c) Shall be liable upon summary conviction by any court "of competent jurisdiction to a fine of not less than $100 nor "more than $200 for the first offence, and to a fine of not less "than $200 nor more than $500 for any subsequent offence".

The Bill as finally passed has been reduced to a registration Bill only.

The Alberta Act provides penalties if any person assumes the title of "Registered Professional Engineer" or assumes any designation that may lead to the belief that he is a Registered Professional Engineer, or member of the Association, or a person specially qualified to practice in any of the branches of professional engineering mentioned in the schedule appended to the Act, also if he acts in such manner as to lead to the belief that he is authorized to fulfill the office of, or to act as a Registered Professional Engineer.

I understand that the Ontario Act as finally passed will be reprinted at an early date, and copies will then be available for distribution.

The sub-committee appointed by you to assist Col. A. W. Gray gave the matter close attention during the session, and the professional engineers throughout the province were not idle.

I also wish to bear testimony to the constant watchfulness of Col. A. W. Gray, A.M.E.I.C., who had charge of the Bill for us.

Respectfully submitted,

(Sgd.) WILLIS CHIPMAN,
Chairman.

June 13th, 1922.

In his letter as secretary, which may be interpreted as expressing the opinion of the committee, Mr. Ewart points out that in view of the fact that all further procedure must now rest in the hands of the provisional council appointed under the Act, the work of the committee was considered to be completed. Those who have followed the activities of the Advisory Conference Committee are unanimous in voicing a tribute to them for their unstinted effort and time unselfishly devoted, having solely in mind the welfare of the profession. Mr. Ewart further shows six advantages to be gained from the present Act:—

(1) Members of the association will be entitled to full recognition under the laws of the other provinces.

(2) It provides for a distinctive designation, which is protected, and which the association can by hard work cause to be recognized more widely by the public as time goes on.

(3) It creates an association which should solidify the professional engineers of Ontario into an effective instrument for carrying the matter further.

(4) All future applications for more restrictive legislation will be made in the name of an organization, which the Legislature has itself created, and which it must therefore fully recognize without question,

(5) Any further concession sought in the future will involve only a short clause or two. It will not be necessary to submit forty clauses or more, each one of which opens the way to some new petty criticism. The advantage of this can be thoroughly appreciated only by those who have had this work in hand.

(6) The lack of any restrictions on practice will enable the association to set a much higher standard for admission to membership than would otherwise have been possible. Under the Bill as proposed it was expected, that no man would be deprived of an established method of livelihood, and thus many men might have to be admitted, for whom the association might later find it very embarrassing to have to stand sponsor.

Continuing, Mr. Ewart said:—

"It was fairly apparent to those who followed the course of the Bill through the House, that our complete desires would never be met at one attempt so long as the House is constituted as at present. Nor was there any reason to feel that it would be any more possible even if a change of government should occur The opposition was not based on any special class prejudice, but came from all classes of members, political and occupational. The only conclusion to be reached, therefore, is that the professional engineers of Ontario will only attain their desires by *working* for them. In the new association we have a medium for such work, that we have never had before."

A Tribute to Peterborough Branch

The position occupied by the Peterborough Branch in the eyes of the community is illustrated by the following editorial comment which appeared in "The Evening Examiner" of Peterborough, on April 8th last.

A Live Organization

The Peterborough Branch of *The Engineering Institute of Canada* has earned the reputation during the past winter of being a thoroughly alive organization, which has been responsible for bringing before the people of Peterborough a programme of educative addresses that have been a benefit to all who have had the pleasure of hearing them. Their enterprise was once more revealed on Thursday night when, thanks to *The Engineering Institute*, a large number of citizens was given an opportunity of being present at a demonstration of the latest triumph of science, wireless telephony. The occasion was the first public test in Peterborough of the radio, and the result was an unusual experience, for those who attended listened to snatches of concert programme from Pittsburg and other cities hundreds of miles away. The capabilities of the radio 'phone were satisfactorily demonstrated, and the kindness of *The Engineering Institute* in making the arrangements for this unique event and inviting the public to be present was thoroughly appreciated. Those who were in attendance on Thursday night will wish the engineers every success in their organization, and will hope that their educational work, which has been so well carried on during the last few months, will continue to give the public a chance to come into contact with the latest developments in the world of science.

PERSONALS

E. R. Woodward, Jr.E.I.C., has accepted a position with Ledoux and Company, metallurgical analysts, in New York City.

F. T. Julian, Jr.E.I.C., is with James Vance, A.M.E.I.C., on road construction on the provincial highway near Woodstock, Ontario.

J. W. Lewis, Jr.E.I.C., is with the Canadian Pacific Railway as transitman on the Woodstock division at Woodstock, N.B.

F. H. Dentith, S.E.I.C., of Halifax, Nova Scotia, has been appointed assistant in chemistry at the Halifax Academy for the coming term.

D. S. McPhail, Jr.E.I.C., is at present located at Fuerto Barrios, Guatemala, C.A., with the engineering department of the United Fruit Company.

M. J. MacMillan, Jr.E.I.C., of Marion Bridge, N.S., is now located at McComas, West Virginia, as assistant to the chief engineer, of the American Coal Company.

Captain J. H. Edgar, A.M.E.I.C., was transferred a few months ago from Montreal to Winnipeg, where he is inspector of materials for the Canadian National Railways.

George Hemmerick, A.M.E.I.C., has been appointed instrumentman on road work for the Ontario Department of Public Highways between New Hamburg and Kitchener, Ontario.

F. H. Kitto, M.E.I.C., is on an exploratory trip in the Digby district of Nova Scotia. Mr. Kitto has recently been made a fellow of the Royal Geographical Society.

Edward C. Little, A.M.E.I.C., formerly construction engineer with D. G. Loomis and Sons, Montreal, has been appointed to the staff of the Divisional Engineer's office of the Welland Ship Canal at Thorold, Ontario.

J. B. Hayes, A.M.E.I.C., a member of the Halifax Branch Executive, lately on the engineering staff of the Nova Scotia Tramways and Power Company, has been transferred to the Boston office of Stone and Webster.

John O'Neill, A.M.E.I.C., of Fredericton, New Brunswick, has recently accepted the position of field engineer on construction with the engineering department of the St. Lawrence Paper Company at Three Rivers, Quebec.

J. H. Thompson, A.M.E.I.C., electrical engineer and chief of the wireless branch of the Radio Telegraph, Department of the Naval Service, has resigned to enter the service of the Marconi Company of Canada, at Montreal.

H. W. Tye, A.M.E.I.C., who was formerly with the C.P.R., at Acme, Alberta, in charge of the construction of the Acme-Drumheller branch is now with the Lacombe and North Western Railway Company at Lacombe, Alta.

W. C. Murdie, A.M.E.I.C., geodetic engineer of the Geodetic Survey Branch, Department of the Interior, Ottawa, is in charge of the triangulation work which is being carried on by the Federal Government in the lower St. Lawrence district.

George H. Carson, Jr.E.I.C., field engineer for the Three Rivers Pulp and Paper Company in Montreal, has recently been transferred to Three Rivers, Quebec, in connection with the work of the newly formed St. Lawrence Paper Mills, Limited.

George E. Newill, M.E.I.C., has been appointed sales manager and engineer in charge of new developments with the Dominion Engineering Works at Montreal. Mr Newill was formerly general manager for the Robb Engineering Works, Ltd., at Amherst, N.S.

John Stephenson, A.M.E.I.C., formerly of the engineering staff of the Nova Scotia Steel and Coal Company is now on the staff of the engineering department of the Bethlehem Steel Corporation, in Bethlehem, Pa., in charge of mill improvements and new construction.

Alex. Roberts, A.M.E.I.C., has been appointed to the engineering staff of the Canadian and General Finance Company Limited, 410, Dominion Bank Building, Toronto, Ont. Mr. Roberts was formerly on the staff of the William Hamilton Company, Limited, at Peterborough, Ont.

A. W. Swan, Jr.E.I.C., until recently on the staff of *The Engineering Institute of Canada* at headquarters, has accepted a position with the Sterling Telephone Company, Dagenham, Essex, England, and has been placed in charge of special statistical work in connection with production control.

H. S. Van Scoyoc, M.E.I.C., manager of the Publicity Department of Canada Cement Company, has been elected vice-president of the Associated Advertising Clubs of the World, the offices of which are at 110 West 40th Street, New York City. This association represents the various local publicity organizations of the country.

William W. Crouch, A.M.E.I.C., of the staff of Black and Veatch, consulting engineers, Kansas City, Montana, has been, until recently, located at Mexico, Montana, and on the completion of the work at that place was transferred to Perry, Oklahoma, in connection with the construction of a sewerage system and disposal plant for the city.

Major J. A. Duchastel, M.E.I.C., chairman of the Montreal Branch, city engineer and manager of Outremont, Quebec, in his capacity as president of the Automobile Club of Canada delivered an address before the Rotary Club of Montreal on Tuesday, July 18th, on "Roads and Streets of Montreal and Vicinity, Past, Present and Future".

F. P. Vaughan, M.E.I.C., of St. John, New Brunswick, has the honour of being the first person to successfully operate a radio broadcasting station in the province of New Brunswick. On May 31st last, the new experimental station, which has just been installed in Mr. Vaughan's laboratory in St. John, was for the first time successfully operated to provide a radio entertainment to the local enthusiasts.

George F. Dalton, A.M.E.I.C., of the Geodetic Survey Branch, Department of the Interior, has recently completed the precise levelling and triangulation control for the topographical survey of the city of Hamilton. This work is being undertaken by the Geodetic Survey in various cities, in order to provide a base, from which a complete topographical survey of the city may ultimately be made.

Norman Marr, A.M.E.I.C., supervising hydraulic engineer of the Dominion Water Power Branch, Department of the Interior at Ottawa, was the recipient of the degree of C.E., at the June Convocation of the University of Toronto. Mr. Marr is a graduate of the University of Toronto and was for a number of years on the engineering staff of the Trent Valley canal, located at Campbellford, Ont.

J. M. Wilson M.E.I.C., of Toronto, received the degree of C.E., at the Convocation last June, from the University of Toronto. Mr. Wilson graduated in civil engineering from Varsity in 1908, and was for a number of years engaged in municipal work, both in Toronto and Moose Jaw. He was appointed district engineer for the Federal Department of Public Works at Toronto in 1914, which position he still holds.

Boyd Candlish, A.M.E.I.C., formerly chief engineer with Herbert Morris Crane and Hoist Company, Niagara Falls, Ont., is now manager of the Detroit branch of Herbert Morris, Incorporated. Mr. Candlish is still acting in a consulting capacity on the design of special hoisting motors, magnetos, brakes and controllers, for both Herbert Morris Crane and Hoist Co., and Herbert Morris, Incorporated.

C. G. Cline, A.M.E.I.C., assistant engineer on the staff of the Ontario Hydrometric Survey, who is in charge of the hydrometric work on the Niagara river for the Dominion Water Power Branch received the degree of C.E., at the June Convocation of the University of Toronto. Mr. Cline, whose office was formerly in Ottawa, has recently been transferred to a new office, room No. 6, Ontario Power Company, Niagara Falls, Ont.

Eugene Vinet, A.M.E.I.C., has been appointed assistant electrical engineer of the Middle West Public Utilities, headquarters, Chicago. Mr. Vinet's departure from Montreal will be regretted by many in the engineering profession. While here he was connected with the Shawinigan Water and Power Company and took an active interest in the engineering profession. He was secretary of the Canadian Electrical Association.

J. B. Challies, M.E.I.C., director of Water Powers, Department of the Interior, is on a western inspection trip in connection with the work of the Department. While on Calgary recently, Mr. Challies was asked to attend a special meeting of the Branch and the members were in this way afforded an opportunity to secure first hand information regarding the work of the Committee on Policy, a report of which was published in last month's *Journal*.

Thomas H. Dunn, M.E.I.C., is among the members of *The Institute* who have recently been honoured by the University of Toronto with the degree of C.E. As a member of the class of 1893 Mr. Dunn received his diploma in civil engineering from the old "School of Practical Science". In 1906 he was admitted to practice as an Ontario Land Surveyor. Ever since graduating Mr. Dunn has been engaged in reclamation work, in connection with which a number of valuable reports of his have been published by the Federal Government.

E. L. Cousins, A.M.E.I.C., who has recently had the degree of C.E. conferred upon him by the University of Toronto, is an honour graduate of the class of '06 of the School of Practical Science. In 1907 Mr. Cousins obtained his degree of B.A.Sc. after a post-graduate course at "The School". During his undergraduate days and for a number of years after graduation he was connected with railway engineering on location, maintenance and reconstruction. He is at present chief engineer of the Toronto Harbour Commission.

R. G. Swan, A.M.E.I.C., engineer in charge of the British Columbia Hydrometric Surveys for the Dominion Water Power Branch, Department of the Interior, recently received the degree of C.E., from the University of Toronto. Mr. Swan graduated from Varsity in 1909 and since graduating has been continuously connected with hydro-electric work, first as concrete inspector with the Ontario Power Company at Niagara Falls, then as engineer on power surveys on the Winnipeg river for the Reese Engineering Company, and later in charge of power investigations in British Columbia, which position he still holds.

J. A. Beauchemin, A.M.E.I.C., has recently been appointed engineer in charge of the engineering department of the Donnacona Paper Company, Limited. Mr. Beauchemin is a graduate of Montreal Polytechnic in Applied Science in 1911, and in the same year was appointed field engineer with the Department of Public Works at Ottawa on the Ottawa River Storage investigations. In 1919 he resigned from the Federal service to accept the position of hydrometic engineer with the Riordon Company, Limited, at Mattawa, Ontario, from which company he severed his connection in 1921 to take charge of power surveys for the Donnacona Paper Company.

Lesslie R. Thomson, M.E.I.C., has been receiving congratulation as designer of the sailing yacht "Antaeis", which, on Saturday July 8th, qualified in the final trial races at Montreal to represent the Royal St. Lawrence Yacht Club in the International Yacht Races against the White Bear Yacht Club at St. Paul, Minnesota, on July 29th, 31st and August 1st. The "Anaetis" was built on Mr. Thomson's design by the St. Lawrence Yacht Club Company, Dorval, Quebec, for a syndicate of members of the Royal St. Lawrence Yacht Club. Among the crew chosen to sail the "Anaetis" at St. Paul is Donald A. White, A.M.E.I.C. F. P. Shearwood, M.E.I.C., who is an authority on yacht design, has been appointed as one of the judges for the races at St. Paul.

Hugh Chambers, A.M.E.I.C., is now acting in the capacity of Canadian Manager for G. D. Peters and Company, Limited, of London, England, who have recently opened up offices in the New Birks Building, Montreal. The Peters Company are manufacturers of rolling stock equipment and selling representatives for various engineering specialities. Mr. Chambers is a graduate of McGill University and prior to going overseas had a number of years experience in mechanical engineering with the Nova

Scotia Steel and Coal Company, with which company he worked up to the position of efficiency engineer. On his return from overseas he was engaged in a consulting capacity in connection with power-plant efficiency. He was later sales engineer and then chief engineer of the General Combustion Company of Canada. Mr. Chambers' past experience will undoubtedly be valuable in connection with his new work.

Major H. J. G. McLean, M. C., A.M.E.I.C., enters Consulting Practice

Major H. J. G. McLean, M.C., A.M.E.I.C., has opened an office as consulting engineer at the Temple building in Brantford. Major McLean has had a wide experience in pulp and paper mill work, having laid out the mills for the Abitibi Pulp and Paper Company; the Dalhousie Lumber Company; the Powell River Pulp and Paper Company; and the Wayagamack Pulp and Paper Company. For eleven years he was with the Waterous Engine Works in Brantford, starting in as an apprentice and rising to be chief draughtsman, in which position he had responsible charge of the design of engines, boilers,

MAJOR H. J. G. McLEAN, M.C., A.M.E.I.C.

road rollers, fire fighting machinery, saw mills, pulp wood machines and layout of the mills. From 1915 to 1918 the Major was with the C.E.F., serving as second in command of the 125th Bn., which was recruited in Brantford. He served with distinction in France, winning the Military Cross. He was afterwards retained as educational officer with the 4th Bn., and served another year with the D.S.C.R., as deputy assistant director for eastern Ontario. On his discharge he entered the employ of the Dominion Engineering Works, designing paper-making machinery and hydraulic turbines.

Beaudry Leman, A.M.E.I.C., appointed Director of Shawinigan Water and Power Company

Beaudry Leman, A.M.E.I.C., was appointed to the vacancy on the directorate of the Shawinigan Water and Power Company, caused through the retirement of S. Roy Marshall of London, England. Mr. Leman commenced his engineering career in the employ of the Shawinigan Company which he joined twenty-two years ago, in the early stages of the construction work, and for six years devoted his time to the development of that important hydro-electric enterprise, at the same time supervising the public improvements which have contributed to make of Shawinigan Falls a model town. He was elected Mayor of Shawinigan Falls for three successive periods of two years.

In 1906 Mr. Leman took an active part in the establishment and construction of the railway which connects the city of Three Rivers with the towns of Shawinigan Falls and Grand' Mere. During his professional career Mr. Leman identified himself with hydro-electric enterprises in the province of Quebec, having made the preliminary surveys for the construction of the Cedars Rapids Manufacturing and Power Company's plant and having also made several reports in connection with water powers in the province.

He was a member of the Electric Service Commission of the city of Montreal, established for the purpose of placing underground electric wires. Mr. Leman, represented for some years a group of Belgian and French Banks interested in Canadian enterprises. In 1912 he entered the service of the Banque d'Hochelaga and is now general manager of that institution.

EMPLOYMENT BUREAU
AND
MEMBERS' EXCHANGE

To make this department more valuable it is proposed that in future advertisements of situations vacant should state salary, and give details of requirements.

Situations Wanted

Mechanical Engineer

Graduate in mechanical engineering, Toronto University, age 26, single, desires position offering experience long this line. Has had some practical experience with gasoline and gas engines and machine shop work. Box No. 108-P.

Electrical Engineer.

Situation wanted by a graduate in electrical engineering, B.Sc., Nova Scotia Technical College, 1921. Has just completed fifteen months in test department of the Canadian General Electric Company, Peterborough, Ontario. Desires location further east. Previous experience consists of four summers at telephone switchboard installation, three summers with the Northern Electric Company, and one with the Automatic Electric Company. Age 23. Unmarried. Apply to Box 109-P.

BRANCH NEWS

Sault Ste. Marie Branch

Geo. H. Kohl, A.M.E.I.C., Acting-Secretary.

At the regular monthly meeting of the Branch on Thursday, May 25th, a number of interesting talks were given on the subject of local dock and pier construction. The Sault Ste. Marie ship canal piers were dealt with by J. W. LeB. Ross, M.E.I.C. This is a matter on which Mr. Ross is thoroughly at home as he is superintendent of the Canadian canal and locks. C. H. E. Rounthwaite, A.M.E.I.C., Member of Council, spoke on the Algoma Central Railway's coal dock construction. W. S. Wilson, A.M.E.I.C., and B. E. Barnhill, M.E.I.C., described the docks of the Algoma Steel Corporation, giving particulars of certain changes it had been found necessary to make in their construction.

Lethbridge Branch

G. S. Brown, A.M.E.I.C., Secretary-Treasurer.

On Saturday, June 23rd, a meeting of the Lethbridge Branch was called to hear an address by Fraser S. Keith, general secretary, who was returning from the British Columbia professional meeting held in Vancouver.

After dinner solos were rendered by R. S. Lawrence, A.M.E.I.C., W. Meldrum, and A. Branch. C. M. Arnold, M.E.I.C., chairman, on behalf of the Branch, extended to Mr. Keith a hearty welcome and expressed appreciation in his paying Lethbridge a visit.

Mr. Keith in opening his address, reminded those present of his visit of a year before, at which time the idea of forming the Branch was conceived, and, in remarking on the growth, stated that this was the youngest Branch in *The Institute* and had made a record due to the interest and enthusiasm shown by the members. He then gave a good insight into the work of the Committee on Policy, which was very instructive and interesting.

Quebec Branch

Hector Cimon, A.M.E.I.C., Secretary-Treasurer.

The annual meeting of the Branch and the election of officers took place at the Chateau Frontenac on the 22nd of May.

The officers elected for the year 1922-1923 are:—

President, A. R. Décary; vice-president, A. B. Normandin; sec.-treasurer, Hector Cimon; councillors, L. C. Dupuis, T. E. Rousseau, *ex-officio:* S. S. Oliver, J. E. Gibault; legislative committee, Alex. Fraser, J. E. Gibault, A. B. Normandin; nomination committee, J. E. Gibault, Hector Cimon, L. A. Dubreuil; conference committee, president, Zachée Langlais; vice-president, Alex. Fraser; secretary, Hector Cimon; A. R. Décary, A. B. Normandin, S. L. DeCarteret, T. E. Rousseau, Arthur Fournier.

In the course of this meeting, an interesting causerie on "Aerial Electric Constructions" was given by Alex. Larivière, A.M.E.I.C., engineer for the Public Service Commission of the Province of Quebec.

Aerial Electric Constructions

Mr. Larivière briefly mentioned that nature has favoured the Province of Quebec with numerous water powers and that many plants have been erected for the production of electricity. He then discussed at length the means of conveying this electricity to the desired points. He gave ample details on transmission lines operating under high voltages used between power plants and distribution stations, and on distribution lines at low voltages which transmit electricity to the consumers. Signal lines, which comprise telephone, either public or private, telegraph and fire alarm systems, formed also an important part of the causerie and the speaker finally concluded in reviewing the progress made in this branch of engineering.

The audience warmly applauded Mr. Larivière and supported the vote of thanks proposed by Z. Langlais.

Calgary Branch

J. A. Spreckley, A.M.E.I.C., Secretary.
Floyd K. Beach, A.M.E.I.C., Branch News-Editor.

Mr. Keith's Visit.

On his way back from Vancouver the General Secretary paid a short visit to Calgary and was entertained to luncheon at the hotel Palliser on Friday, July 23rd. He was accompanied by Major A. A. Young, A.M.E.I.C., who conveyed greetings from the Winnipeg Branch, and there was a good attendance of those members whose duties do not compel them to be in the field at this time of the year.

After referring to the Good Roads Conference at Victoria, Mr. Keith gave a clear résumé of the recent findings of the Policy committee, and the circumstances leading up to these valuable recommendations. He commended the proposals to the careful consideration of the Branch and pointed out the recent widening of the scope of *The Institute* to include the social and economic welfare of the members, in addition to protecting their professional status. Steps are being taken to bring the Branches into closer touch with the Council, and to associate every member with a local Branch. He pointed out the difficulties encountered in attempting to prepare a schedule of remuneration and classification, and gave one instance where such a scale would have been appreciated by a city executive, engaged in reclassifying his staff. Professional recognition depends in some measure on remuneration, but can be greatly helped by education of the student members in ethics and the practice of public speaking. A vote of thanks was accorded on the motion of Councillor G. W. Craig, M.E.I.C., and the opportunity of discussing *Institute* affairs was much appreciated.

Institute Policy.

J. B. Challies, M.E.I.C., the chairman of the Policy Committee, spent a few hours in Calgary on Wednesday, July 12th, and the opportunity was taken for him to meet the executive and Policy committees of the Calgary Branch, to discuss *Institute* affairs in an informal way, at luncheon in the Board of Trade rooms. Mr. Challies briefly outlined the main objects of the recent report prepared by the Policy committee, and pointed out that while recent developments have brought the Branches into closer touch with Headquarters, it is now proposed to bring in the unattached members, so that they may be kept in close touch with the work of *The Institute.* He mentioned a few cases in which *The Institute* has used its influence to help certain classes of its members, and those who attended the luncheon now have a closer appreciation of the good work which is being done by the Council in furthering the interests of the membership as a whole.

William Pearce Irrigation Project.

E. F. Drake, Associate E.I.C., director of the Reclamation Service, has been making his annual visit to the west this summer, and has made a personal inspection of the large area covered by the proposed North Saskatchewan Irrigation Project. He was accompanied by D. W. Hays, M.E.I.C., as consulting engineer, and V. M. Meek, A.M.E.I.C., the acting commissioner of irrigation. The proposal is generally known as the William Pearce Irrigation project, and provides for water to travel a distance of 400 miles by natural and artificial channels, from the foothills in the west, as far as Saskatoon. No other irrigation system on the continent carries water for this distance, but the scheme is understood to be practical from an engineering standpoint, and the most important question which enters into the consideration of the whole project is the actual demand, by the farmers in the area affected, for irrigation. In some of the districts farthest from the source of supply it is questionable if the farmers are all agreed on the need for irrigation.

Informal Dinner.

The Calgary Branch was fortunate in being given an opportunity to welcome Brig.-Gen. C. H. Mitchell, M.E.I.C., Dean of the Faculty of Applied Science and Engineering of the University of Toronto, at an informal dinner, held at the Board of Trade rooms on Monday evening, July 10th. Although very short notice could be given there was a very gratifying turnout of the members. A special effort was made to notify all graduates of the Toronto Faculty of Applied Science and Engineering, and a good percentage of these were present. After the dinner any formality which might have existed was laid aside, acquaintances were renewed, reminiscences of undergraduate days were indulged in, and college scraps fought over once again. The old school yell was given with a vim, and then the "Psalm of Life", dear to all "School Men", was sung. Parodies on popular songs worded to suit the occasion followed at intervals and helped to round off the social part of the evening's programme. General Mitchell, M.E.I.C., was kept very busy renewing old acquaintances and meeting new ones in his well-known genial manner.

The meeting was called to order about nine o'clock by the chairman of the Calgary Branch, P. J. Jennings, M.E.I.C., and the guest of honour, General Mitchell, gave a very interesting address. The speaker outlined briefly the history of engineering in Canada in its various branches throughout the past fifteen or twenty years, and stressed the importance of the work of engineers to the interests of not only the community in which they worked, but also of the nation and the Empire as a whole. He urged that they owed a debt to the country in which they had received their education and training, and they could best pay if off by taking a more active part in civic affairs, or anything which would help to build up their community, and the country in general. The General went on to outline, in an interesting manner, the history of the various courses in the Faculty of Science of the University of Toronto, the civil engineering course, from point of number of students entered, having held first place for a number of years, but since the start of the war certain conditions brought other lines, notably chemical engineering, to the fore, so that last year's civil engineering had dropped to fourth place. The General expressed his opinion that upon the return of normal times he anticipated there would be a greater demand for civil engineers and a consequent increase in the number entering that course. The speaker's remarks with respect to the additions which have been made to the courses in the Science Faculty at Toronto in recent years were of great interest, since the graduates present at the meeting had finished their training, they were of special interest to them, and all were agreed that a decided improvement had been effected by these additions, as from the experience of every graduate, the lack of them in his own course proves more or less of a handicap. The additions included were technical English, law of contracts, and a systematic training in public speaking.

In commenting upon general business conditions throughout Canada, General Mitchell was very optimistic. He stated that things were steadily improving, and expressed the opinion that within the next two years they would return to normal. Believing this, he warned engineers that they should be ready to broaden out as opportunities arose, and keep pace with the changing of the times.

L. C. Charlesworth, M.E.I.C., chairman of the Irrigation Council of Alberta, fortunately happened to be passing through the city and was able to attend the meeting and take part in the discussion.

P. M. Sauder, M.E.I.C., of the Lethbridge Branch, moved a vote of thanks to the speaker in a few well chosen words, in which, on behalf of the graduates in particular, he expressed the pleasure felt in renewing acquaintance with General Mitchell, and hearing at first hand, and in this intimate way, of the activities of the "Old Red School House". G. W. Craig, M.E.I.C., city engineer of Calgary, seconded the motion, speaking more particularly on behalf of those present who were not graduates of Toronto.

A short discussion followed, in which a number of the members and graduates took part, and what proved to have been one of the most successful meetings of the Branch adjourned at 11 o'clock.

Cape Breton Branch

Kenneth G. Cameron, A.M.E.I.C., Secretary-Treasurer.

Regular meetings of the Branch have been suspended according to custom, during the summer months, but seasonable opportunities for visits or outings are being taken.

H.M.S. "Raleigh", flagship of the North Atlantic Squadron, recently called at Sydney Harbour, and by arrangement with Vice-Admiral Pakenham, the members of the Branch paid a visit to the ship, where they were received by the engineer commander and his staff. Members were accompanied by ladies, and on arrival on board, divided themselves into groups, which, each conducted by one of the staff, had every opportunity granted them of investigating the points of interest. Although classified as an improved light cruiser, the "Raleigh" is no mean boat and, in equipment, represents the most modern practice that has hitherto been stationed in these waters. She is a turbine driven, oil-burning vessel, 600 feet in length, developing 31.5 knots at 65,000 to 70,000 h.p. For those members interested in mechanical design, the visit was of great interest, and all too short.

Several changes have occurred recently among the Branch membership. D. F. MacIsaac, A.M.E.I.C., member of the executive since the formation of the Branch, and one of the promoters, and hard workers during its infant stages, has left this district for Upper Canada. C. C. Curtis, M.E.I.C., general manager of the Cape Breton Electric Company, has been appointed to the Executive committee for the remainder of Mr. MacIsaac's term, John Stephenson, A.M.E.I.C., is now with the engineering department of the Bethlehem Steel Corporation, Bethlehem, Pa. H. A. Roberts, Jr.E.I.C. and Clarence MacKay, Jr.E.I.C. both formerly of the Dominion Iron and Steel Company, are now with the Canadian Bridge Company, Walkerville, Ont.

Hamilton Branch

W. F. McLaren, M.E.I.C., Secretary-Treasurer.

The Hamilton Branch is particularly interested in a new industry which is locating in Hamilton for the purpose of manufacturing fire brick. The construction of the new plant for the Canadian By-Products Company, Limited, in connection with this undertaking, is in charge of E. Howard Darling, M.E.I.C., consulting engineer, of Hamilton, Ontario, who is also a director of the compapy.

Sewage Disposal

The city of Hamilton is wrestling with the problem of sewage disposal. The rapid expansion of the city has far outgrown the present sewage disposal plants and it is estimated that fully two-thirds of the sewage goes into the bay without treatment. In order to cope with future needs the City Council is endeavouring to select a firm of consulting engineers to furnish expert advice.

Halifax Branch

O. S. Cox, A.M.E.I.C., Secretary-Treasurer.

A special meeting of the Halifax Branch was held in the Nova Scotia Technical College, June 22nd, 1922, with the vice-chairman, Ira P. MacNab, M.E.I.C., in the chair, and J. B. Hayes, A.M.E.I.C., acting as secretary, at which a talk on the subject "Valuations", was given by Edward L. Moreland, of the firm of Jackson and Moreland of Boston. The meeting was called to order at 8.15 p.m. with an attendance of approximately one hundred including a number of non-membership guests

Mr. Moreland explained that he had not prepared a formal paper but would outline his subject and then throw the meeting open for questions, trusting that the answers to the questions would bring out more detailed description of methods employed. The valuations are made in general for two purposes:—

(1) Valuations for bankers in order to justify the issuing o bonds, securities, etc. In this case a few qualified engineers spen a few days in sizing up the property and reporting.

(2) Valuations of public utilities for rate making purposes In this case a much more detailed study of the property mus be made.

Mr. Moreland sketched the history of public utilit regulation, showing how procedure had changed from a competitive period of non-regulation to our presen system of commissions. The fundamental thing is rate changed; and to fix this the value of the plant must b known. This cannot satisfactorily be determined fron the company's records, as frequently the existing concer is the survivor of several old ventures, or an amalgamation Hence the necessity of the system of estimating values

A number of systems are in vogue, such as:— (a) Reproduction cost; (b) original cost; (c) depreciate value. In the United States the courts have laid dow the principle that valuations must be considered fron several bases. The process Messrs. Jackson and More land uses is: — (1) Make an inventory of the propert from the company's records and check them. (2) Appl to this inventory unit costs, similar to ordinary construc tion costs. To obtain new costs is relatively simple a present costs are known. More difficult it is to go bac to actual time of construction, but company's record are helpful.

There are two ways to arrive at "depreciation".

(1) *Theoretical.* What may theoretically be expected b assigning a probable useful life and using a percentage. Th fact that plant may become obsolete is a factor in estimatin probable life.

(2) *Depreciation by Inspection.* Our opinion is — fair valu for rate-making purposes is the amount of money put in — fu value as long as property is kept in good working condition. property is not kept up, a sum should be deducted equal to tha required to bring the property up to good condition. This woul be carefully distinguished from depreciation. Many disagree wit this view and think that depreciation should be deducted.

Mr. Moreland sketched the method used in determ ining the indemnity that should be paid by German for all physical damage done in the allied countries. H was technical adviser to the commission. Unit costs wer used, and in the case of destroyed towns, "a cost pe capita" was established by estimates of the costs o various sized undamaged towns adjacent to the devastat

ed area. The chief result of the investigation was to fix the *proportion* of the damages among the Allied nations, rather than the gross amount.

The meeting was then thrown open for discussion and Mr. Moreland answered questions asked by a number of the members. A vote of thanks to Mr. Moreland was moved by C. E. W. Dodwell M.E.I.C., and seconded by L. H. Wheaton, A.M.E.I.C.

Ottawa Branch

F. C. C. Lynch, Associate E.I.C., Secretary-Treasurer.

The Engineer's Bill is passed, and as a Branch the engineers of Ottawa congratulate the Toronto members on their effective work. Interest is now centred in the action to be taken by the provisional council towards the organization of the new Association of Professional Engineers. While the Bill does not, and could hardly be expected to at first, grant all the powers requested, Ottawa recognizes it as a tremendous step towards the goal which the profession has for a long time been working.

The Year Book of the Ottawa Branch has just been issued, and shows a considerably increased membership, and much activity on the part of the Branch.

OTHER SOCIETIES NEWS

American Society of Civil Engineers Annual Convention

The fifty-second annual convention of the American Society of Civil Engineers, which was held at Portsmouth, New Hampshire, on June 21st and 22nd, provided a programme of very interesting and instructive technical papers and a diversity of pleasurable excursions and other entertainments. Among the contributions to the technical programme were the following papers by members of *The Engineering Institute of Canada:*

"Problems in Connection with the St. Maurice River Regulation" by O. O. Lefebvre, M.E.I.C., chief engineer of the Quebec Streams Commission.

"The Gouin Dam on the St. Maurice River" by James H. Brace, M.E.I.C., vice-president of Fraser Brace and Company, of Montreal.

Canadian Engineering Standards Association

The Sub-Committee on Rating and Testing of Electrical Machinery held its first meeting in Ottawa on June 16th, Prof. E. G. Burr, A.M.E.I.C., in the chair.

The chairman pointed out that the sub-committee had been formed to consider the advisability of the adoption or formulation by the C.E.S.A., of Canadian standardization rules for electrical machinery, covering the same ground as and preferably based upon, the rules of the American Institute of Electrical Engineers. As a result of preliminary correspondence, it appeared that practically all the members of the sub-committee were in favour of the adoption of the A.I.E.E. rules, subject to such amendments or changes in arrangement as may be found desirable. This decision was confirmed by the meeting. Discussion followed as to the best organization for the work, and three Panels were appointed to deal respectively with the rules for rating and testing of: — (1) Large motors, generators, and rotating machinery operating under controllable conditions; (2) Industrial sizes of motors and generators working under ordinary manufacturing or operating conditions; (3) Transformers of various types.

The existing Transformer Sub-Committee would, of course, be consulted as regards the work of Panel No. 3.

Consideration was given to the best method of keeping the sub-committee in touch with American committees working along the same lines, and it was decided that the fullest possible co-operation should be arranged for through the American Engineering Standards Committee.

Western Canada Irrigation Association

The sixteenth annual irrigation convention of the Western Canada Irrigation Association is being held at Maple Creek, Saskatchewan, July 26th and 27th, and at Brooks, Alberta, July 28th and 29th. The Western Canada Irrigation Association includes in its membership a large number of members of *The Engineering Institute of Canada*, many of whom occupy outstanding positions in irrigation development in the Dominion.

Under the Association's constitution *The Engineering Institute* is entitled to three delegates nominated by the Council, and two from each of the western provinces, Saskatchewan, Alberta and British Columbia.

In addition many of the delegates of other organizations will include members of our own *Institute* so that a large percentage of the personnel of these gatherings is included from our own membership.

The executive of the Association includes A. S. Dawson, M.E.I.C., Calgary, V. Meek, A.M.E.I.C., Calgary, and G. N. Houston, M.E.I.C., Lethbridge. An account of the convention will appear in the next issue of *The Journal*.

Trade Publications

The Industrial Diamond and Its Uses.—A booklet of particular interest to engineers has recently been issued by Furniss Clarke and Company, of 32, McGill College Avenue, Montreal, which throws an altogether new light on the uses to which diamonds may be put. In this publication is given a short historical sketch of some of the more famous diamonds together with some details of interest regarding the more important diamond mines, while the main part of the text is devoted to the uses of the industrial diamond and the care required in setting or re-setting the diamond in the tools in which it is used.

Stock List of Steel.—The Dominion Bridge Company, Toronto office, has forwarded a copy of their current Stock List, of steel shapes and other metal products for immediate shipment. The booklet contains several pages of weights, safe loads for beams, channels, angles, etc., and general information. They will be pleased to forward members a copy on request.

CORRESPONDENCE

Reforming the Calendar

Vancouver B.C., July 12th, 1922.

Editor, *Journal:*

Dear Sir:—

Recent years have witnessed a rapidly growing movement among scientific, ecclesiastical and legislative bodies in Europe and America towards calendar reform. English speaking nations use the Gregorian Calendar, but the Julian, Arabic, Jewish and Chinese calendars serve over twice as many people, and even this is not the complete list. From this great variation in the almanac and the closer communication between nations, has arisen the desire for some way of relieving the confusion of dates and day names, with its contingent complications.

Local interest, to members of the Vancouver Branch, is added because the author of the most widely endorsed plan, Moses B. Cotsworth, F.G.S., F.S.A., F.C.A., though a native of York, England, is a resident of New Westminster, B.C., and a staunch Canadian. Mr. Cotsworth's high attainments are well known, through his researches in the field of commerce and his valuable works such as "Railway Maximum Rates", (the British standard) or, "Direct Calculators" and "Reciprocals" which are widely used by professional and scientific men, and the government departments of nearly all nations.

He commenced his research in the field of calendar reform in 1894 after much laborious and painstaking investigation of ancient and modern systems of time measurement, involving lengthy study in many countries and localities, he wrote a book of about five hundred pages entitled "The Rational Almanac", which was published in 1905, followed a few years later by a smaller book, "Time to Fix the Year", which embodied a review of his discoveries and a definite plan to reform the calendar. This scheme was given the unqualified approval and support of the late Sir Sanford Fleming, K.C.M.G., the originator of "Standard Time", who introduced it to the Royal Society of Canada. This body, after careful investigation, passed a resolution at its annual meeting in 1912, endorsing Mr. Cotsworth's proposal, and afterwards petitioned the Canadian Government to request the Imperial Government to call an international conference at an early date. The Canadian Government, subsequently endorsed both the petition and Mr. Cotsworth's plan.

The war dampened the interest in this question for several years, but on February eighth of the present year, a national convention was held at Washington, D.C., to discuss calendar reform, at which eleven proposals were presented for consideration. Mr. Cotsworth's scheme, known as, "The International Fixed Calendar" showed such marked superiority, that a unanimous resolution was passed, endorsing it as the simplest, most conveniently arranged and most desirable of all the plans submitted, and recommending its adoption by all the law making bodies of the nations of the world. Subsequently Mr. Cotsworth was invited to give an illustrated lecture on "Measures of Time" at a private meeting of the members of the Senate and House of Representatives.

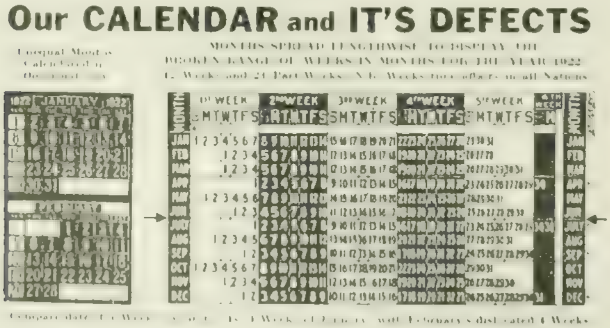

Fig. 1

With the support of such powerful agencies as have just been enumerated, and the fact that "The International Fixed Calendar" is already well known in Europe, it is altogether likely that the calendar will be reformed at an early date on Mr. Cotsworth's plan. Such briefly is the progress of the movement up to the present time.

The whole question is epitomized in Mr. Cotsworth's statement:— "We need a monthly measure in which the day names, with regard to the commercial dates, will be fixed". The truth of this assertion is clearly depicted in figure No. 1.

He further observes that our months vary from twenty-eight to thirty-one days, eleven per cent difference, yet the same monthly salaries, rents, etc., must be inequitably paid. Monthly business charges for maintenance, depreciation, etc., are unfairly apportioned, and monthly profits credited as though each month were productively one-twelveth of the year. Monthly trade balances, wage adjustments, etc., are complicated by weekly wages being split up in the weeks, which, beginning in any one month, quarter, semester or year, end in the next following. Nine of the months extend into five weeks and three into six, as a glance at the chart, (figure No. 1), will show.

Lack of space precludes a full explanation of the method of reform; but the following brief outline of Mr. Cotsworth's plan should suffice to familiarize the members of *The Institute* with it's main points.

(1) The length of day, weeks and years to remain unaltered, but the months to be made a uniform length of twenty-eight days in seven-day weeks, the amended year to consist of one day plus thirteen twenty-eight day months, making the present year length of three hundred and sixty-five days. He proposes to place the odd day at the beginning of the year and call it "New Year's Day, a universal holiday designated January 0. The business year would then commence on January first with the customary week-day names. He suggests numbering instead of naming the months, or if naming be preferred, introducing the new month "SOL" between June and July. Figure No. 2, illustrates the proposed standard month.

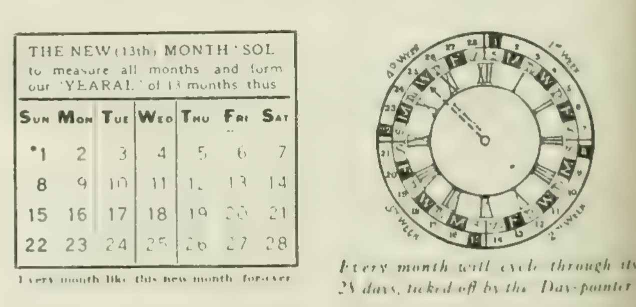

Fig. 2

(2) The extra day in leap years to be inserted as a midsumm holiday not called by any week-day name, and designated Sol 0, July 0.

(3) The date for Easter to be agreed upon by the internation churches, and permanently fixed.

(4) The date of commencement of the new calendar to be fixe by agreement.

(5) An international government conference of all nations to l assembled for the purpose of drafting joint legislation for ratificatio by each government.

In a recent article in the June number of the "Bulletin of tl Pan-American Union", Mr. Cotsworth concludes with the observati that "in addition to other benefits the reform will cause nine per ce more circulation of all monthly moneys now used for monthly accoun salaries, rents, etc., (without any increase in capital outlay), theret increasing business and social prosperity." This feature will undoub edly appeal to the engineering profession, as an economic advanta apart from other promised benefits of the proposed reform.

Yours very truly,

P. H. BUCHAN, A.M.E.I.C.,
Secretary Treasurer,
Vancouver Branch.

Preliminary Notice

of Applications for Admission and for Transfer

20th July, 1922

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in Aug., 1922.

FRASER S. KEITH, Secretary.

*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option, Railway, Municipal, Hydraulic, Mechanical, Mining or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects, Geography, History (that of Canada in particular), Arithmetic, Geometry, Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits scientific acquirements ,or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge

The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BAILY—PAUL, of 208 Bernard St., Montreal, Que. Born at Namur, Belgium, July 23rd, 1890; Educ., C.E., L.Sc., Univ. of Ghent, Belgium, 1912; engr. Belgium Govt., one year; engr., Fabrique Nationale and Armes de Guerre, Herstal, Liege, Belgium, one year; engr., Aerators Limited of London, England, until 1915; asst. ch. engr., and naval architect, Canadian Vickers, Ltd., Montreal, 1915-20; designing engr., Belgo Canadian Pulp & Paper Co., Shawinigan Falls, one year; at present asst. City Engineer of Verdun, Que.

References: A. Ghysens, C. J. DesBaillets, G. Claxton, J. L. Busfield, J. Stadler, H. Hadley, J. A. Lacouture, E. Cormier.

CAMPION—WILLIAM, of St. Catharines, Ont. Born at Stantonbuty, England, 25th Sept. 1890; Educ., 5 yrs. classes, science and technology, Board of Education, London, Eng.; 1905-12, app'tceship, building of lolling stock, upkeep of steam plant and machinery and testing of materials used in works, London and North Western Rly., Wolverton; 1913 (six mos.) dft'g. and designing, chiefly struct'l. work, Marine Signal Co., Ottawa; 1914-20, sole mech. dftsman, eng'gd. on drafting Ore dressing machinery, layouts, drawings for reports and for buildings etc.. connected with mines branch, Dept. Mines, Ottawa; 1920, chg. designing, dft'g. and estimating, Electric Steel and Metals Co., Welland; to date, asst. engr., design of machinery, locks, gates wires, etc., Welland Ship Canal, St. Catharines, Ont.

References: O. W. Ross, A. W. L. Butler, J. McAndrew, F. E. Sterns, W. H. Sullivan, W. B. MacDonald.

CRABTREE—HENRY SWIFT, of Toronto, Ont. Born at Halifax, England, March 29th, 1892; Educ., Elland Grammar School, England and 4 yrs. machine design and maths., Mechanics Inst., Halifax, Eng.; app'tceship, Lumby Engineering Works, Greetland; 1913-17, dftsman, Routley & Summers, Haileyburn and chf dftsman, during work for Abitibi Power Co., Iroquois Falls, survey, layout etc.; 1917-18, dftsman and designer, Trussed Concrete Steel Co., Walkerville, Ont.; commer. trav'lr., Dominion Machinery Co., Toronto; occasional work Sutcliffe and Neelands, New Liskeard; 6 mos., chg. design of tools and machinery, Automative Products Co. Ltd., (then Knight Metal Products Co.); dftsman, Smith, Kerry & Chase, Toronto; at present dftsman and designer, work consists of platting surveys, bridge work, structr'l. and reinforced concrete, office work, etc., Dept. of Public Highways, Toronto, Ont.

References: A. E. Jupp, H. T. Routly, G. Hogarth, N. A. Burwash, R. M. Smith, W. A. MacLachlan, C. E. Bush.

FALKNER—JOHN WILLIAM, of Summerland, B.C. Born at London, England, 26th June, 1889; Educ., special engr'g. course, King's Coll., Univ. of London, 1919-20 and pvte. tuition; 1911-12, asst., W. H. Salmon, chief engr., on constrn. of Imperial Paper Mills, Gravesend, England; 1912-15, Articles as Land Surveyor with W. H. Powell, Vancouver, B.C., municipal and railroad work; 1916 (Jan.-April) asst. to Mr. Shepherd, engr., constrn. Dominion Sugar Co.'s. Beet Sugar Plant, Chatham, Ont.; 1916-18, asst. to W. L. Ketchen, engr. in chg. of constrn., Riordon Pulp & Paper Co., as follows:—levels for 30" C.I. underground water line, boiler house constrn., constrn. 4 reinforced concrete Acid Towers, etc., at Merritton; engr'g. office work and constrn. and equip'mt., with proposed Sulphite Pulp Mill, Hydro-electric development, Hawkesbury and Temiskaming; 1920-21. plans for Box Board Mill, Port Sunlight, supervis'ng, constrn., general layout, steel design, foundation plans, specifications etc.

References: W. L. Ketchen, W. H. Powell, C. B. Thorne, W. Brand Young, R. F. Davy, P. Philip.

FREELAND—EDWARD EWING, of Ottawa, Ont. Born at Brandon, Man. Jany. 10th, 1885; Educ., B.A.Sc., Univ. of Toronto, '12; 1908-10, student asst., on Phoenix and Slocan, B.C., topographical maps; 1912, junr. top'gr., on Texada B.C. map for Topographical Divn., Geological Survey and 1913-21, topogr'cl. mapping and in chg. of field and office work in connection with the compilation of the maps, as follows:— 1913, Bridge River, B.C., 1914, Sheep River, Alta., 1915, Sudbury, Ont., 1920, Marmora, Ont., 1921, Missanabie, Ont.; 1916-19, overseas service; at present, topog'r. engr. Topographical Divn., Geological Survey, Dept. of Mines, Ottawa, Ont.

References: W. H. Boyd, J. D. Craig, O. S. Finnie, J. L. Rannie, C. P. Edwards.

HOWE—CLARENCE DECATUR, of Port Arthur, Ont. Born at Waltham, Mass., Jan. 15th, 1886; Educ., B.Sc., Mass. Institute of Technology, '07; 1904 (summer) transitman, county engr. of Middlesex, Mass; 1905-09 (summers), desig'ng. engr., J. R. Worcester & Co., Boston, Mass; 1907-08 (Sept.-May), asst. in struct'l. engr'g. dept., Mass. Inst. of Technology; 1908-13, prof. of civil engr'g., Dalhousie Univ., Halifax, N.S., and consltg. engr., on factory and warehouse structures; 1913-16, in chg. design and constrn., terminal grain elevators at Saskatoon, Moose Jaw, Calgary and Vancouver; as ch. engr., Bd. of Grain Comm. for Canada; 1916 to date, partner C.D. Howe & Co., consltg. engrs., in chg. design and constrn., grain elevators, pulp mills, warehouses and miscell. structures, also reports and valuations on engr'g. projects, Port Arthur, Ont.

References: F. Newell, L. M. Jones, G. W. Craig, H. H. Vaughan, J. F. Greene, C. N. Montsarrat.

JENNINGS—MICHAEL WALLACE, of Port Arthur, Ont. Born at St. John, N.B., March 12th, 1889. Educ., B.Sc., New Brunswick Univ., '11; 1907-08, jr. dftsman, chainman and rodman, survey and constrn., and 1910, (summer) rodman, constrn., Nat. Transc. Rly., New Brunswick; 1911-12, chainman on mtce., C.P.Rly., Atlantic distr; 1912 (summer), asst. to highway engr., City of St. John, N.B.; 1912-13, dftsman. on constrn., Nat. Transc. Rly., St. John, and 1913-15, at Cochrane, Ont.; 1915 (May-Dec.), dftsman on mtce., Can Govt. Rlys., Cochrane and as follows:— 1915-16, chief clerk to distr. engr., 1916, (July-Sept.) asst. engr., 1916-17, acting divn. engr., territory, O'Brien, P.Q., to Superior Junction, Ont., and 1917-18. asst. engr., Cochrane, Ont.; 1918-19, asst. engr., Can. Nat. Rlys., Cochrane, Ont.; 1919 to date, asst. engr., Can. Nat. Rlys., Port Arthur, Ont.

References: W. T. Moodie, A. V. Redmond, J. E. Gibault, G. H. Burbidge, C. O. Foss, E. W. Robison.

KEARNS—NORMAN HENRY, of Sarocaba Falls, Estado de Sao Paulo, Brazil. Born at Toronto, Ont., June 17th, 1896; Educ., B.A.Sc., Univ. of Toronto, '19; 1912 (summer), chainman and rodman, Blaar Str. Viaduct, preliminary survey; 1917-18, testing and research engr., Canadian Aeroplanes, Limited; 1919-20, asst. to City Engineer, Corporation of Niagara Falls; 1920 to date, civil engr., in chg. drafting room and constrn., Sao Paulo Electric Company, Limited, Sarocaba Falls, Estado de Sao Paulo, Liuha Sarocabana, Brazil, So. America.

References: P. Gillespie, W. J. Smither, L. M. Arkley, T. Taylor, D. T. Black.

STEWART—ANDREW ERNEST, of Moose Jaw, Sask. Born at Ottawa, Ont., Sept. 1st, 1892. Educ., B.Sc. (C.E.) Univ. of Saskatchewan, '22; 1909-15, chainman, rodman and instr'man, C.P.R.; 1915-19, sapper and corpl.' Canadian Engrs., France; 1919, Lieut. Royal Engineers, 3rd Sappers and Miners, Poona, India and in third Afghan War, Chaman, Baluchistan; 1920 to date, asst. to divn. engr., Revelstoke, B.C., with the exception of Oct. 1920 to Apr. 1921, and 1921-22, spent at university completing course started before the war.

References: J. R. C. Macredie, C. J. MacKenzie, A. R. Greig, T. C. Macnab, A. L. Ford.

WEATHERHEAD—ALBERT VICTOR, of Amherst, N.S. Born at Leicester, England, July 3rd, 1894; Educ., 4 yrs. Toronto Tech. Coll.; 3 yrs. dftsman, C. E. Good, C.E., Toronto, Ont.; 1914-15, survey dftsman, plotting from field books, making profiles, estimates etc., Canadian Govt. Rly. survey, under Engineer Herbert S. Clarke of Toronto; 1916-18, overseas service Canadian Engineers; 1919-20, engaged by Prov. Highways Board to erect concrete bridges throughout the county; 1921-22, paving, retaining walls, etc ; at present architect concrete engr., and contractor, specializing in concrete constrn., Amherst, N.S.

References: F. C. Wightman, H. F. Donkin, W. L. Ball, J. Cumberford, D. W. Robb.

YATES—RICHARD EDWARD, of St. Catharines, Ont. Born at Chorley, Lancs., England, May 24th, 1890; Educ., Public Schools and Chorley Tech. School; engaged with Welland Ship Canal as follows:—1913-16, rodman, 1916-19, leveller, and 1919 to date, instr'man, section no. 3, Thorold, Ont.

References: A. J. Grant, F. S Lazier, W. H. Sullivan, C. W. West, E. P. Murphy.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

HEARNE—ALFRED ROBERT JAMES, of Pukow, China. Born at Meerut, India, Octr. 30th, 1876; Educ., Royal High School, Edinburgh, Scotland; 1896-99, app'tceship, North British Rly. Co., engr'g. dept., Edinburgh; 1899-02, served in South African War; 1903-04, asst. engr., Natal Govt. Rly., on reconstrn., of main line; 1904-05, asst. Govt. surveyor on topogr. survey of Zululand Coast Lands; 1905-06, asst. engr., on constrn. of Natal Cape Line; 1906-07, dftsman on Can. Nthrn. Rly., Montreal; 1907-08, asst. engr. in chg. party on survey, location and constrn., C.P.R., Irrig. dept., Alberta; 1909, asst. engr., Chinese Govt. Tientsin Pukow Rly.; 1916, promoted distr., engr.; periods varying 6 mos. to a year, acted as engr. in chief of British Section of Tientsin Pukow Line; 1919, promoted engr. in chief; at present engr. in chief, Han-Pu District, Chinese Govt. Tientsin Pukow Rly., Nanking, China.

References: H. B. Muckleston, A. S. Dawson, N. P. Dalziel, R. A. C. Henry, F. S. Keith.

MACINTYRE—AIMWELL GORDON, of Bear River, N.S. Born at Upper Georgetown, N.B., Feby. 4th, 1888. Educ., B.A. Acadia Univ., '10, B.Sc., Acadia Univ., '12, B.Sc., McGill Univ., '12; 1909 (summer), asst., geological survey; 1910 (summer), topog'r., geological survey; 1911 (summer), chemical engr., Jonquieres Pulp Co.; 1912, (May-Dec.) res-engr., on constrn., Price Bros., Kenogami, Que.; 1912-14, editor in chief, Pulp and Paper Magazine (Technical); 1913-14, supt., Forest Products Laboratories (at McGill time); 1913-14, organizer and first secy.-treas., Canadian Pulp and Paper Assn.; 1914-15, mgr., in chg. design, constrn., and operation, Pulp and Paper Divn., Bathurst Lumber Co.; 1915-17, genrl. mgr., in chg. design and constrn. Mattagami Pulp and Paper Co.; 1917-19, consltg. expert American Newspaper Publishers Assocn., New York; 1919-20, chairman Board of Directors, Ironside Board Corporation Norwich Comm., and at present, president, Clarke Brothers, Limited, Bear River, N.S.

References: G. K. Addie, R. O. Sweezey, W. G. Mitchell, K. H. Smith, C. A. Waterous, G. G. Hare.

VERNON—BRUCE, of Montreal, Que. Born at Philadelphia, Pa., Oct. 3rd, 1887. Educ., C.E., Univ. of Penna., '08; 1908-12, dft'ng., estimating and designing of steel and reinforced concrete bldgs., Dolce & Co., Philadelphia; 1912-14, in chg. all designs steel and reinforced concrete bldgs.; 1914-15, supt. in chg. all outside work; 1915-16, engr. in chg. design of paper mill and hydro elec. plant, Kerry & Chase, Toronto; 1916-18, engr. in chg. of building design and constrn. and 1918 to date, principal asst. engr., Montreal Tramways Company, Montreal, Que.

References: K. B. Thornton, W. F. Graves, R. M. Hannaford, P. A. N. Seurot, D. E. Blair, G. R. MacLeod.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

MANSBRIDGE—ALFRED S., of Walkerville, Ont. Born at Manchester, England, December 17th, 1886; Educ., Public School and Evening classes; 5 yrs. app'tceship, drafting room, machine and fitting shops; 2½ yrs.; chainman and rodman, various surveys in and about Vancouver, B.C.; 1913-15, asst. to chf. dftsman., Pac. Gt. Eastern Rly., Vancouver; 1915-17, gunner, Can. Field Artillery; 1917 (6 mos.), Sergt., attached Can. Royal Art., as dftsman; 1917-18 (6 mos.) Canadian School of Gunnery; 1918-19, Lieut. Can. Field Art.; 1919 (2½ mos.), hydrographic survey, Vancouver Board of Harbour Commissioners; 1919 to date, engr. and dftsman, Trussed Concrete Steel Company, Walkerville, Ont.

References: A. J. Riddell, H. C. McMordie, J. Clark Keith, F. P. Flett, J. E. Porter, H. W. Frith, C. R. Crysdale, E. G. Matheson.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

SHOTWELL—JOHN STUART GLASHAN, of Ottawa, Ont. Born at Hawkesbury, Ont., Mar. 9th, 1900. Educ., 3 yrs. chemical engr'g., McGill Univ., 1918, (summer), asst. chemist, fuel testing plant, Dept. of Mines; 1919, (summer), chemical asst., Dominion Observatory, Ottawa; 1920 (summer), asst. chemist, Dept. of Agriculture; 1920 (fall), asst. J. T. Donald & Co., Montreal; 1920-21, demonstrator mech. engr'g., McGill Univ.; 1921 (2 mos.), J. R. Booth's Pulp Mill; 1921 to date, investigation into natural resources and preparation of graphical charts, Natural Resources Intelligence Branch, Dept. of the Interior, Ottawa, Ont.

References: P. Sherrin, W. F. M. Bryce, W. J. Peaker, C. M. McKergow, A. R. Roberts.

WILSON—HUGH ALLEN, of Montreal, Que. Born at Montreal, July 4th, 1896. Educ., B.Sc., McGill Univ., '22; 1913-15, survey parties eng'gd., on constrn. work, C.P.Rly.; 1920 and 21, (April-Octr.), asst. supt., in chg. mechanical work including stationary and aeroplane engines of seaplane station, Canadian Govt., at Roberval, Lake St. John; 3 yrs. active service in command of seaplane station and second in command of expedition of seaplanes to North Russia with chg. of flying operation and organization; at present in chg. of tests being run on all mech'cl., apparatus throughout plant and improvements and re-arrangement of present steam system with Canadian Salt Co., Ltd., Windsor, Ont.

References: H. Rolph, C. M. McKergow, H. M. Lamb, C. Batho, E. Brown, A. R. Roberts.

— THE —

ENGINEERING JOURNAL

THE JOURNAL OF THE ENGINEERING INSTITUTE OF CANADA

SEPTEMBER 1922 **Volume V, No. 9**

CONTENTS

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Extensions to the Hydro-Electric System of the City of Winnipeg.

Additional Units installed in the Point du Bois Plant, on Winnipeg River.

E. V. Caton, M.E.I.C.,

Chief Engineer, City of Winnipeg Light and Power Department.

Paper to be presented at the General Professional Meeting, Winnipeg, Man., September 5th, 1922.

The hydro-electric system of the city of Winnipeg has been fairly well described in the electrical press. A paper before the Canadian Society of Civil Engineers by W. G. Chace, M.E.I.C., in 1911, described in detail the original installation. One by Dr. Herdt before the same society in 1914 described subsequent extension to the system, and various articles in the Electrical News, Toronto; Engineering, London; etc., have appeared. The present paper is descriptive of the recent extension carried out in 1919 and 1920, but a brief review of the original work is necessary for the proper presenting of the subject.

Without going into details, the original installation, completed for operation in 1911, consisted of practically all the hydraulic work, (dams, forebay, etc.), for a final development of the site, including the construction of the whole of the up-stream wall of the power house, into which the wheel pits are built. Allowance was made for the ultimate installation of sixteen units. Seven wheel pits were completed with eight draft tubes and the power-house buildings to accommodate eight machines, the remaining nine pits being completed only sufficiently to act as a gravity dam across the forebay end, sufficient being done, however, to allow of the completion of the wheel pits and draft tubes without any coffer-dam work on the up-stream side.

Five machines, consisting of twin-runner horizontal turbines of 5,200 h.p., connected to 3,000-k.w., alternators, were installed, together with transformers and switching to control same. Subsequently the eighth wheel pit was completed and three additional units consisting of twin-runner horizontal turbines of 6,900 h.p., connected to 5,000-k.w., generators were installed and one 9,000-kv.a., 3-phase, transformer, thus completely filling the original power-house building. In 1916 it was decided to complete the remaining eight draft tubes, and in 1919 it was evident that the final completion of the power house would be necessary to accommodate the machinery required to take care of the growth of the load.

Building Extension

The extension to be described consisted of the completion of the eight wheel pits and the final addition

to the power house proper to accommodate eight additional generators and their necessary apparatus.

The general design of the building followed very closely that of the original work, with such alterations as experience had shown to be desirable. The difference consists chiefly of the extension of the whole power house in a down stream direction to allow of more room for switching and the building on at the extreme end of an unloading bay, large machine shop, oil room and office space. From the cross-section shown on figure No. 1, it will be noted that the power house may be divided into three bays, viz. — wheel pits, generator room, transformer and switch bay.

Machinery

The addition to the plant consisted of three horizontal, double-runner, water turbines. These machines were guaranteed to deliver 6,800 h.p., at 150 r.p.m., under a 46-foot head, and on test gave 7,800 h.p., on full gate, the corresponding specific speed being 110. No means were provided to actually measure the efficiency, but the guarantees were as follows: Full gate 80%; 0.85 gate 85.5%; 0.80 gate 85.0%; 0.70 gate 82.0%; 0.60 gate 80.0%. In view of the fact that the draft tube and wheel pits were identical to those designed for the 5,200-h.p., units, it would appear that these efficiencies must be closely approached. Figure No. 2 is of interest, showing the velocity of water through the draft tube for the original 5,200-h.p., unit and the new 7,800-h.p., units.

The machines are of the three bearing type, all bearings under water, including the thrust, are lignum-vitae. The water being exceptionally free from grit or sand these bearings have proved very satisfactory and have eliminated the grease cups and other apparatus necessary with the babbit type of bearings.

An interesting development in these machines is the installation of curved plates in the draft tube, immediately behind the runner discharge end, the idea apparently being to distribute the flow evenly through the entire runner. It is the intention at some future date to remove these plates and test the machines to see what their effect on the actual machine is.

The governing is of the oil operated servo motor type, and the following are extracts from the specification for same and are of interest in that no actual speed regulation was asked for but the time of operation of the governor pendulum and servo motor was specified.

> "The pendulum and valves shall be so designed and related that the servo motor pistons will commence movement with a variation of turbine speed of one-quarter of one per cent.
>
> The servo motor shall be designed for an oil pressure of 150 pounds per square inch and shall be capable of making its full stroke either way in not more than two and one-half seconds when connected to the turbine gates under normal head."

The reason for so specifying was due to actual tests on the eight existing machines, which had given considerable governor trouble before they were finally accepted from the makers. As an indication that this method of specifying the governors was correct for the case in point, no trouble whatever has been experienced in putting the new unit into commission and perfect parallel operation and speed regulation has been obtained. It is not suggested that this method of calling for governors is applicable to *all* cases or for individual machines, but where machines are already installed it gives the assurance that satisfactory governing will be obtained and also takes away from the governor manufacturer the uncertainty of figuring on hydraulic conditions of which he has no exact data.

Generators

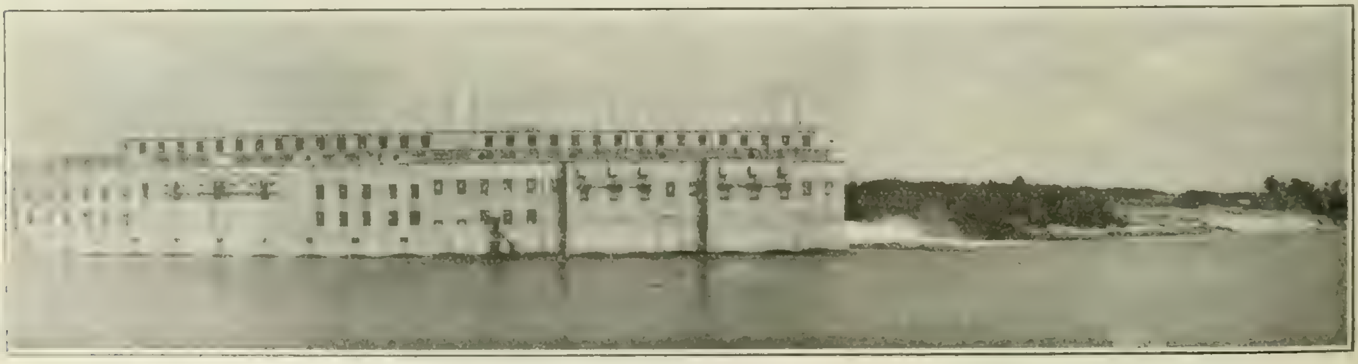
The generators are rated at 6,500 kv.a., maximum rating, are provided with temperature indicators in the winding, and have a fly wheel effect of 3,500,000 W.R.[2] Each machine is provided with its own direct connected exciters of 58 k.w., capacity at 125 volts. Air operated brakes were provided but owing to the excellent fitting of the gates the use of these has not been found necessary.

The old exciting system consisted of two 250-k.w., water-driven exciters, but as it was impossible to provide for water turbines for additional exciters it was decided to equip all of the existing machines with individual exciters, and the end of the main shafts were machined and drilled to take the half coupling flange of the exciter, the exciters being placed on concrete pedestals. The question of providing the additional exciter capacity by motor-driven exciters was considered, but the unsatisfactory operation of this class of apparatus under system trouble led to the individual system being finally decided upon.

The old exciters are being replaced by two 310-kv.a., 220-volt, alternators, which will supply power for the pumps, light and other station services.

Transformers

Three oil-insulated, water-cooled, transformers were installed, each being of 5,000 kv.a., capacity at 35°C rise, and having a continuous rating of 6,000 kv.a., at 50°C rise.



City of Winnipeg Hydro-Electric Power Plant.

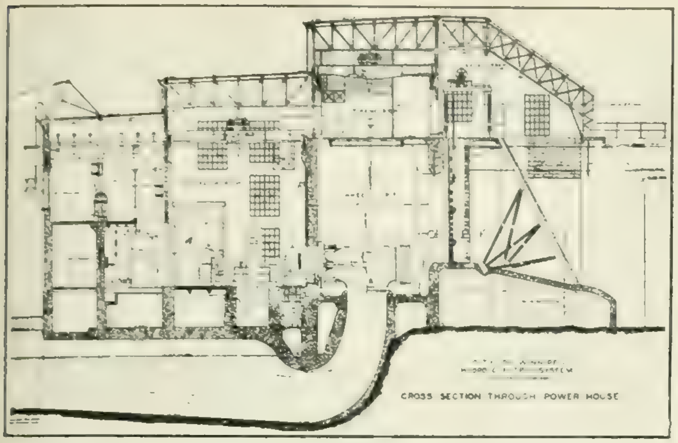


Figure No. 1. City of Winnipeg Hydro-Electric Plant, Power House Cross-Section.

Governor Oil System

As the eventual power-house will contain sixteen machines, it was considered that individual governor oil pumps on each machine would result in too high maintenance costs and excessive attention being required. To obviate this a central pumping system has been installed, consisting of three motor driven gear oil pumps, delivering oil at 200 pounds per square inch pressure to a common piping system, which will eventually run the entire length of the power house. This pipe line is in duplicate and the governor mechanism of each machine is connected to either of these pipes through valves and through an oil storage tank of sufficient capacity to allow of the gate operating several times without the pressure falling too low to operate. Pressure is maintained by air pressure supplied from a small motor driven air compressor.

The discharge from the servo motor is returned to the pump sump by a large cast iron header. The pumps run continuously, discharging into the oil sump through an unloader when the machines are not taking oil. The system is designed on the open system, ample ventilation of the oil tanks to a point above the power-house roof being provided. Arrangement is made in the piping to allow of the oil in the sump tanks being treated through a centrifugal oil separator while the pumps are in service. At present only the three new machines are connected to this system, but eventually all will be.

Head Gates

In the original plant each wheel pit had its own head gate, operated from a system of gears. In the new section the gate operating gear is mounted on a carriage similar to a stop log lifting device, running on rails over the various wheel pit openings, and is operated by a 15-h.p., d.c., motor, mounted on the carriage.

The gates are in three sections of structural steel and steel sheathed, wood labyrinth seals ensure a water-tight joint between the sections. All three sections are hung on to the carriage when not in use and can be swung by means of travelling blocks into position for lowering into the gate slots. In actual practice these gates have proved themselves to be everything that was expected.

Switch Gear

Due to the ultimate size of the plant, and the possibility of tying in with other plants at a later date, the switching and control gear was given very careful study. It was evident that the existing switching and bus work was inadequate for these conditions and it was decided to install complete new switching for the entire plant. This could be economically accomplished since the existing switching could all be used in the city extensions.

Figure No. 3 shows the existing and ultimate installation.

All 6,600-volt switches have now been placed in the extreme down-stream bay of the new extension. Complete duplicate bus-bar systems have been provided and the switches grouped in sets of five, i.e. — four machines and one transformer bank. The individual groups are placed at right angles to the length of the power house and the main bus run along the south wall. The switches are in concrete compartments, sub-compartments disconnecting switches are provided on the machine side of the switch, the disconnecting switches on the bus side being the wall mounting type. All disconnecting switches are provided with locks.

Special care was taken in the construction to allow for all mechanical and temperature stresses. All the supports are of the extra heavy type and they are arranged to be always in compression, the ultimate stress being taken up by the main structure. Due to the extreme

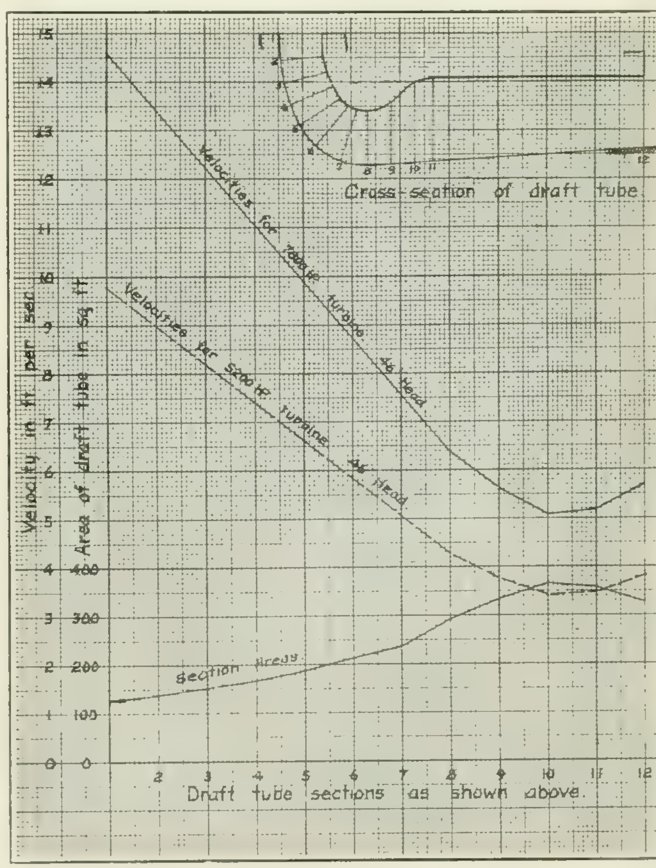


Figure No. 2. City of Winnipeg Hydro-Electric Plant. Velocities and Areas through Draft Tubes.

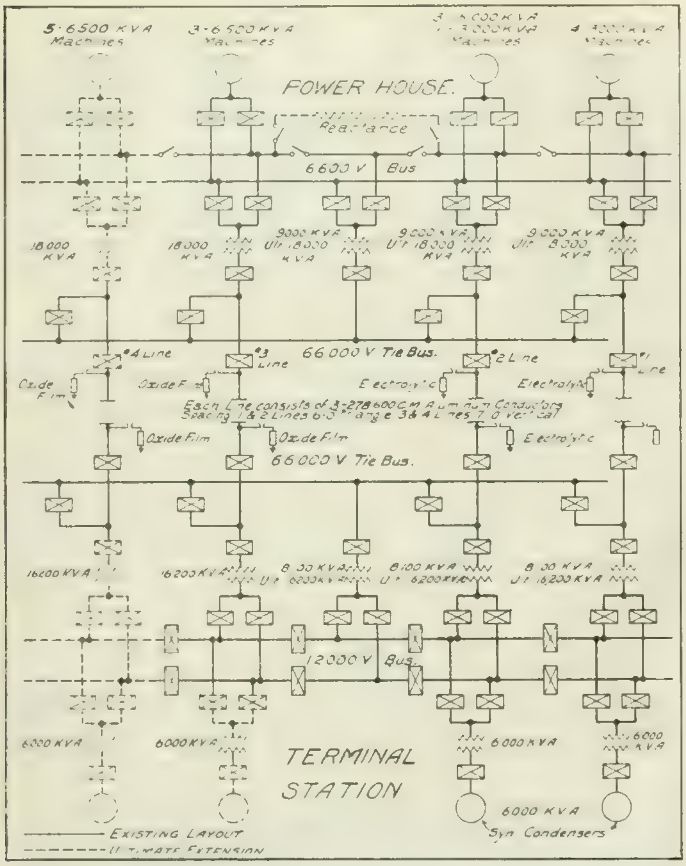


Figure No. 3. City of Winnipeg Hydro-Electric System. Line Diagram System.

temperature changes, special provision had to be made for the expansion, not only of the bus bars but also of the slab structure itself. This was accomplished on the south wall barrier by supporting the slabs on one end in the wall into which they were grouted, and on the other edge on a steel angle, which allowed the slabs to move in one direction. The bus clamps allow the bus to expand in the direction of their length but up-and-down motion is prevented. By anchoring at definite points, the expansion is controlled and no deflection of the bus can take place under the limits of temperature to be expected. Up to date no cracks or breakages have appeared on any of the structures.

All cables leading to the switch or from the machine are single conductor, cambric insulated, flame proof braided, carried on asbestos covered structural steel supports in the basement.

Special care was taken in the layout and design of the control wiring, it being the endeavour to allot a definite position for each control cable throughout its entire run and to minimize the usual control wiring complication as much as possible. This was done by the use of multi conductor, lead covered control cables, run in open steel trays. All individual wires are braided in different colours and a definite colour scheme has been maintained throughout the system. All control and instrument wires run through a terminal and test panel before going to the control and instrument board.

By keeping all relays, instruments, and recorders on their own sets of panels, a very accessible and open wiring scheme has resulted and any control cable may be easily located without interfering with any of the others, test instruments may be inserted into any circuit without disconnecting any leads, and any individual sections of the control wiring can be easily localized in the case of trouble.

The high tension line switches and oxide film arresters are placed on the floor immediately above the low tension switches. The high tension transformer bank switch and tie switches being placed above the transformer compartments. The relay protection provided is balanced relays on the generator, the star point being opened and current transformers inserted. The other transformers are immediately below the switches so that the relays protect not only the machines but also their cable systems. The same method is provided for the transformers, the current transformers for the high tension side being of the bushing type. Overload induction type relays are used on the high tension lines.

Transmission Line

Two new transmission circuits have been provided. The cables are 278,600 c.m., aluminum, carried on steel towers placed along the present right-of-way. The towers are of three types, four legged braced, flexible towers and lattice poles, spaced on 400-foot centres. Extra heavy towers are placed at all angles and dead ends. A $\frac{3}{8}$ steel ground wire is strung along the top of the towers. Pin type, 80,000-volt insulators, mounted on forged steel pins, are used, except at angles and dead ends where suspension type insulators are used.

In addition to sectionalizing switches placed at five points along the line, a switch tower at Tyndall, thirty-eight miles east of Winnipeg, allows of the cross connection of all five lines. When first put into operation it was found that owing to the close proximity of the new lines to the telephone line considerable interference was caused. Drainage coils, consisting of 15-k.w., standard pole type transformers with their 2,200-volt coils connected across the line and middle point grounded, were placed at each end and completely eliminated the trouble.

The additions in the city consisted of the installation of additional switching in the terminal station to handle the two new lines, and oxide film arresters on each line. Also an additional transformer bank of the same capacity as that installed in the power house. The general scheme of switching is similar to that at the power house, the low tension switching installed being the switches which had been discarded at the power house.

Principal Manufacturers and Machines Installed

Water Turbines: Boving Company of Canada. 7800-h.p., 150 r.p.m., 46-foot head.
Generators: Canadian General Electric Company. 6500-kv.a., 6600 — 7200 v., 3-phase, 60-cycle.
Transformers: Canadian Westinghouse Company. 5000-kv.a., at 35°C rise, 6600–66000 volts, S.P., O.I., W.C.
Canadian General Electric Company. 5000-kv.a , at 35°C rise, 66000–12000 volts, S.P., O.I., W.C.
Switching: Canadian General Electric Company. H-6, 6600 v.
Canadian Westinghouse Company. G-A, 70,000 v.
Lightning Arresters: Canadian General Electric Company, oxide film.
Transmission Towers: Canadian Bridge Company.
Transmission Cable: Northern Aluminum Company.
Insulators: Canadian Porcelain Company. No. 1810.

Improvements to Moncton Yard and Engine Facilities

Construction Methods employed to Minimize Interference with Traffic.

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The city of Moncton is situated on the Canadian Government Railways at the junction of the main line from Halifax to Montreal and the line from the city of St. John, and is also the eastern terminus of the Transcontinental Railway, which makes it the gathering point for traffic from the west to Halifax, Sydney and all points east of it, as well as the breaking-up point for traffic in the opposite direction. By reason of this fact it is the most important railway junction point in the Maritime Provinces, and requires adequate facilities for handling traffic rapidly and efficiently, and also for distributing empty cars and equipment of all descriptions to points where needed. For a number of years the yard has been too small to provide the necessary working capacity, and the tracks too short to accommodate the long trains hauled by the new large locomotives. The roundhouse and other facilities, which were old, were too small and without proper facilities for making the running repairs to the present-day large locomotives.

Layout of the Yard and its Approaches

As will be seen from figure No. 1, the old connection with the main line and transcontinental line, with the yard, is near the east end, and by means of a wye connection; the tracks parallel to the west leg of the wye being used for a freight receiving yard from, and those parallel to the east leg as a departure yard for, trains to the north. These tracks were too short to hold the long trains, which resulted in a great deal of terminal detention. All of the freight coming to and from these tracks had to be shunted across the St. John main line, which caused an excessive amount of shunting and congestion. To eliminate this condition, and so simplify yard movements, a diversion was constructed from mile 3.5 on the north main line to mile 2.5 on the St. John sub-division, thence parallel to the St. John sub-division to the yard. By this means all traffic enters the yard from the west, making a simple east and west yard, except for the transfer to the Moncton shops, which traffic, being only local, is small. A very complete ultimate layout has been designed which includes east and west receiving yards, classification yards, which may be equipped with humps if required, east and west departure yards, transfer and storage tracks, new car repair facilities, new engine facilities, etc., so located that the construction of any additions or extensions required to meet traffic conditions may be carried on without materially interfering with traffic. This yard is arranged in units so that it may be constructed and operated in sections as the traffic demands. The conception and design of this general layout originated with Collingwood B. Brown, M.E.I.C., recently chief engineer, Canadian Government Railways, and now engineering assistant, to the vice-president, Canadian National Railways, Toronto. All of the expenditures and construction up to date have been in accordance with this ultimate layout.

Construction Work

The actual work of construction was commenced in the season of 1919, and consisted of three parts:

(1) The acquiring of additional land which was required on both sides of the present yard to provide for present and future requirements, and to avoid farm crossings.

(2) The construction of the diversion from the main line to north, referred to above. The maximum grade used was 0.6 per cent, compensated for curvature, and involved the raising of the St. John sub-division, a height of 6.5 feet at the under crossing of the Salisbury road, mile 1.8, and extension of this bridge from a single

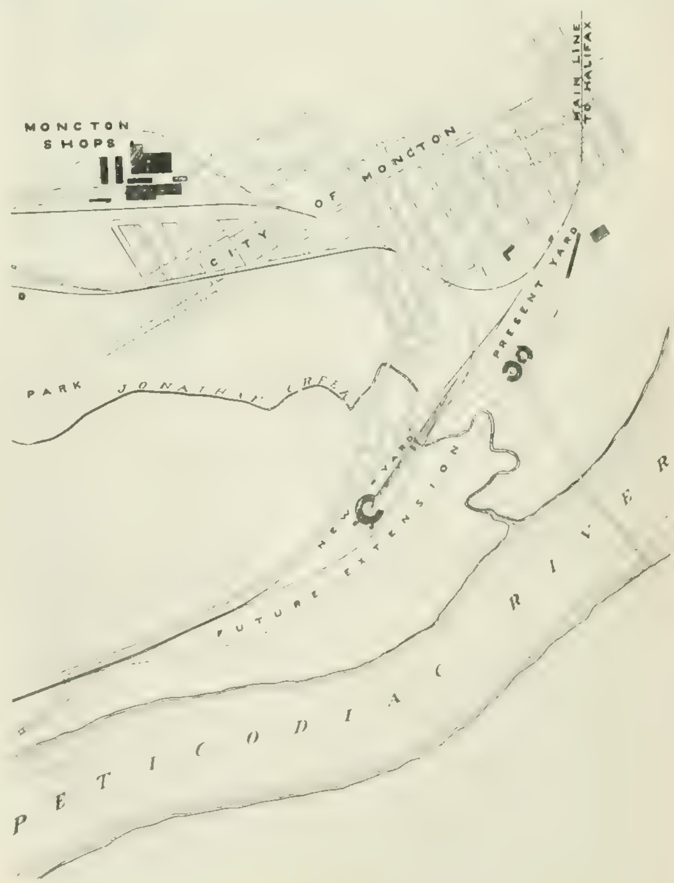

Figure No. 1. Plan of Moncton Yard Layout with Approaches

track to a three track structure. The contract for this work was awarded to the Dominion Construction Company Ltd., and Wheaton, late in the season of 1919, and the work was completed early in 1920. A considerable saving in operating expenses was effected during the first winter by the use of this diversion for freight movement, although the old line was continued for passenger traffic use.

(3) Construction of freight shed and freight transfer platforms. The old freight shed was very inadequate for the local and transfer traffic. A new shed with additional trackage, arranged to conform with the new layout, was constructed. The structure is 400 feet long by 40 feet wide, of brick and structural steel construction. The contract for this work was awarded to engineers and contractors of St. John, and the work was completed early in the season of 1920. A transfer platform 500 feet long was also constructed, conforming to the new layout.

Construction Work during 1920

The engine house, coaling plant, and other engine facilities, are located on the high ground, where foundation is good, just west of Johnathan creek, which crosses the yard at about mile 0.6 and flows across the marsh, the level of which is approximately 25 feet below the grade elevation. This marsh has an average width of about 400 feet, the Johnathan creek culvert being located at its extreme west side. The ground west of the culvert for a distance of 5,000 feet was generally above grade, ranging from zero to fifteen feet, which necessitated a considerable amount of excavation. The material was required partly to widen the embankments at the extreme west end of the yard, but mostly to make the embankment over the Johnathan creek marsh.

An extension of the Johnathan creek culvert under the old yard was also necessary. This culvert is a double six feet by six feet concrete rail top structure and the extension on its upper end is 312 feet long. The original stream crossed the marsh diagonally, necessitating a diversion to bring it to the inlet of the culvert. In order to have the site ready for buildings during the season of 1921, the construction of the culvert extension and grading for the site of the buildings was performed in 1920, so far as it could be done without interfering with the operation of the old yard. A contract for this work was awarded to the Dominion Construction Company Ltd., and Wheaton, and the work was completed by the end of 1920, about 95,000 cu. yds. of material having been excavated, and the culvert extension and stream diversion completed. One special feature of this work is worthy of mention, namely, the efficient method of handling the foundation excavation from the culvert and the excavation for the stream diversion. For this work a movable stiff-leg derrick on a base of heavy hard pine timber was constructed, and on it was mounted the hoisting engine, which served at once as a counter weight and supplied the power for operating the derrick for handling heavy materials, the orange-peel bucket for excavating, and was also used to propel the whole apparatus by means of deadmen. This machine was placed ahead of the work and rolled on a grillage of timber and rails which distributed the load over considerable area so that no difficulty was encountered supporting the machine, as is so frequently the case in handling movable derrick apparatus close to the edge of excavation.

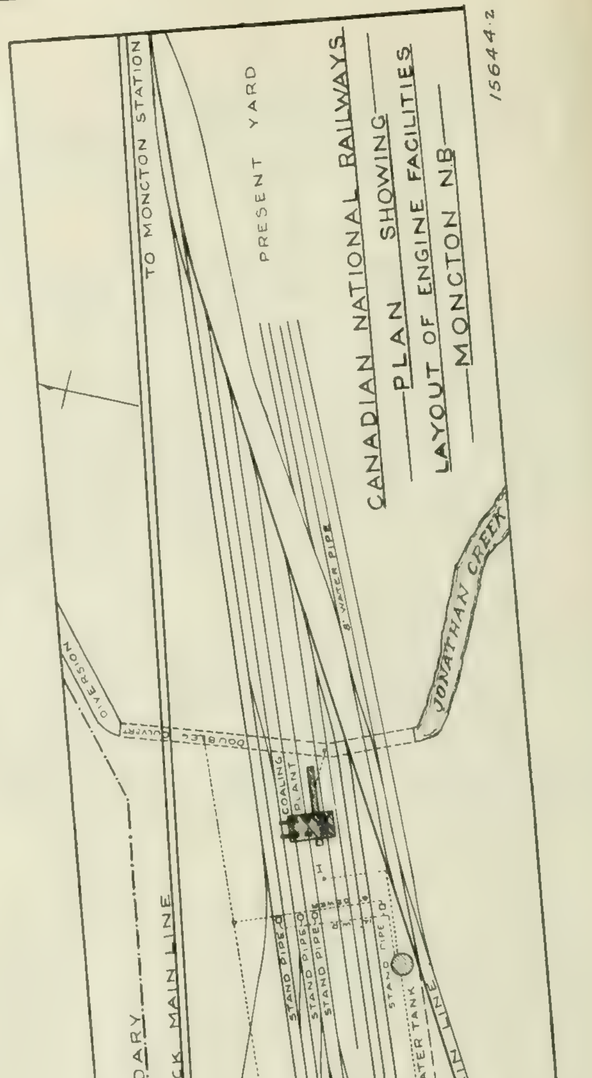

Figure No. 2. Plan of Moncton Engine Facilities.

Work during 1921

The work during 1921 consisted of continuing the grading, diverting the main line, and construction of buildings and service tracks as shown in figure No. 2. It will be seen that a locomotive approaching the facilities will, under ordinary conditions, obtain the necessary attention in the following order; coaling and sand, water, fire cleaning, housing. Three inbound and three outbound tracks have been provided, all of which are served by stand-pipes for water. Coaling facilities are provided on the three inbound tracks, and by means of cross-overs, locomotives on two of the outbound tracks may be coaled with very little interference with the inbound locomotives. Four tracks have been provided with ash-pits and sufficient cross-overs have been provided to facilitate any desired movement of the locomotives. Fifty tracks to the turntable have been provided for, four are running tracks to and from the turntable, forty are entrances from the turntable to the forty stall house, which is now constructed, and space for an additional six stall section when required. All buildings except the water tank and coaling plant are constructed of brick on concrete foundations with mill type frames of B.C. fir, except the machine shop which has a structural steel frame. This is one of the largest layouts for a single engine house in Canada.

As much of this work had to be performed in the present yard, without interference with traffic, it was decided to do it by the railway's own forces under the supervision of the chief engineer, A. F. Stewart, M.E.I.C., with the construction engineer, S. B. Wass, A.M.E.I.C., and assistant engineers, E. R. Evans, A.M.E.I.C., and H. L. Currie, A.M.E.I.C., directly in charge of the work.

When the work was approved very few detail drawings were prepared, and these were made as quickly as possible in the chief engineer's office by H. J. Crudge, A.M.E.I.C., assistant engineer of buildings, R. G. Gage, M.E.I.C., signal and electrical engineer, and C. S. G. Rogers, A.M.E.I.C., assistant engineer of bridges, for ash-pits, and steel water tank. The field work was divided into two units, each reporting to the construction engineer, and each consisting of assistant engineer and a small staff, with general foreman, and as many other foremen as necessary. One timekeeper and one materialman, with some temporary assistants were employed on the whole work. E. R. Evans was assistant engineer in charge of grading, etc., with T. McPherson as general foreman, and H. L. Currie was assistant engineer in charge of buildings, with D. A. Seaman as general foreman. G. N. Allen S.E.I.C., was timekeeper on the whole work. Special attention was given to the design and installation of the heating and piping systems by H. F. Finnemore, A.M.E.I.C., and to lighting by F. H. Williams, A.M.E.I.C., both assistants to Mr. Gage.

Several small contracts were awarded for special work as follows: Steel water tank, Dominion Bridge Company, Montreal; coaling plant machinery, Williams and Wilson, Montreal; tar and gravel roof, Carrite Company, St. John; plumbing, Johnston Bros., Moncton; oil storage system, B. F. Bowser Company, Toronto.

Grading

It will be seen, by reference to figure No. 2, that the main line of the St. John sub-division and the Reid's cut yard lies across the site of the proposed engine house, on a grade, and at a different elevation than that of the new work. It was therefore necessary to construct a new main line well in advance of building operations. Owing to the necessity of maintaining traffic, cutting both sides and under the main line, and to the irregular shape of the excavation required, ten cuts of the shovel were required; this with the shallow excavation, varying from two to fifteen feet, entailed a comparatively large amount of shifting of the shovel. The material encountered was heavy clay and hard pan. Some of it was used to widen the embankments at the west end of the yard, but most of it was deposited in the embankment over Johnathan creek marsh. The equipment used consisted of one model-60, Marion steam shovel, twenty-four Kilbourne and Jacobs, 16-yard air dump cars, one Jordon spreader, and two Consolidated locomotives.

In view of the shallow excavation and the settlement in the marsh, the shovel record would seem to be good. The shovel started work on April 11th and completed September 14th, having excavated 158,000 cubic yards, averaging 31,600 cubic yards per month, or 1,200 cubic yards per working day.

Sewer System

As the buildings were all located on the natural ground, composed of hard pan, very impervious to water, it was important that drainage be provided for the foundation excavations at the earliest possible moment, and the most effective method was to get the permanent sewerage system installed. This was entirely new and independent of all other sewers except for the coaling plant sewer, which, on account of its proximity to the culvert, has a separate connection with it. It discharges into the top of Johnathan creek culvert through a specially constructed manhole near its upper end.

The main sewer, extending from the outlet to the manhole opposite the ash-pits, is of twenty-four inch double strength, vitrified clay pipe 798 feet long, placed fourteen feet below grade so as to drain the ash-pits. From this main sewer, branches of smaller sized pipe are carried to the turntable pit, engine wheel drop pits, and all other facilities requiring drainage. The total amount of excavation for sewer trenches was 4,960 cubic yards in hard pan material merging into rock, so that hand labor was considered to be too slow. Several alternative methods were discussed and it was finally decided to try a Marion railroad ditcher which was available. This machine was supported over the top of the trench on old bridge stringers and in one operation excavated the trench in front of it and deposited the material behind itself, the pipe having been laid and jointed by men working directly underneath the machine. Some difficulty was encountered with a seam of quicksand about ten feet below the surface which caused the sides of the trench to cave in, but this was only for a short distance. The machine would dig only about ten feet below its support, so in order to excavate the bottom of the trench the machine had to make a surface cut, about four feet deep, wide enough to permit the timbers to rest on the bottom of it. So successfull was this method that frequently fifty-five lineal feet of completed sewer was laid in a working day, and an average of thirty-two lineal feet per day was maintained during the whole sewer

operation. The cost of trenching under the conditions encountered was easily less than half what it would have been by hand. The main sewer was commenced on April 28th and was carried almost to the turntable, so that all foundations could be readily drained by May 30th. The early completion of this sewer removed all necessity of pumping water from foundations.

Description of Buildings

The stall engine house contains forty stalls; thirty-three of which are 100 feet in length with 65-foot pits, and seven are 120 feet long with 80-foot pits. The house is divided into sections each of which is separated from the adjoining sections by fire-proof walls and doors. The sections are as follows: Commencing on the south-easterly corner, two sections of seven 100-foot stalls; one section of seven 120-foot stalls; one section of nine 100-foot stalls, and one section of ten 100-foot stalls. Three of the long stalls are provided with drop pits for driving wheels, and two with drop pits for tender wheels, so located that any pair of wheels on any of the railway's existing locomotives may be changed. The drop pits are all equipped with Taylor-Arnold pneumatic jacks. Each stall is provided with steam blower, with Barco connection, blow-off pipe. wash-out and boiler filling pipe, cold water connection, compressed air, all of which systems are connected with the power house, where the various pumps, hot-well, etc., are located.

The machine shop which is 84 feet long by 53 feet wide and is located at the back of the long stall section of the roundhouse and connected to it by a passage-way is provided with machines for light repairs, tool room and forge with jib cranes for handling heavy parts, and a narrow gauge push-car track between the machine shop and the roundhouse stalls.

The stores and office building is 100 feet long by 30 feet wide. The foreman's office is in the west end of the building, and adjoining it are the booking and registering room, locker room, wash room, shower bath, etc., The oil cellar, fully equipped with storage tanks, and ten self-measuring and registering oil pumps, is in the central portion of the building. The eastern end of the building to be used for miscellaneous supplies, is fitted with racks and shelves, and surrounded with an eight-foot platform with ramps. This building is heated by low pressure steam, supplied by the power house boilers.

The power house is attached to the back of the twelfth stall of the engine house and is eighty-seven feet by forty-four feet. It is divided into two parts by a brick wall, the back part of which contains two 250-h.p., Babcock and Wilcox water-tube boilers, which were in use in the old power house, but have been re-tubed, thoroughly cleaned, and repaired. The other part contains the air compressor, feed-water, wash-out and vacuum pumps, and steam driven fan and heater coils. A hot-well is located just outside the power house for storage of hot water. This hot water is used for feed water, refilling locomotive boilers, thus affecting a great saving in fuel.

The electric current is obtained from the railway's own system developed at the Moncton shops. It is used for operating the coaling plant and motors in the machine shop, in addition to a complete lighting system throughout. The lights in the engine house are so arranged with reflectors on the posts that an abundance of light may be obtained for work on any part of the engine, but economy may be effected by turning off those not required, as each stall is supplied with separate switches.

A mechanical coaling plant of 350-ton storage capacity, equipped to elevate coal at the rate of fifty tons per hour, was installed. It is provided with three coaling tracks, and one hopper track for receiving coal. It is operated by electric power from the railway system. The machinery was supplied and installed by Williams and Wilson Limited, of Montreal, under contract, but the construction of the building and all other work was done by the railway forces. Facilities are also provided for sand storage and supplying sand to locomotives at this plant.

Water is obtained from the city water-supply and a connection with the present nine-inch main just opposite the passenger car power house, and an eight-inch cast iron pipe, 3,343 feet long, was carried to the new facilities. A steel tank of 150,000-gallon capacity is provided as a storage reservoir. Four ten-inch standpipes are provided for watering locomotives, also connection to all buildings and facilities. The steel water tank was supplied and erected, by the Dominion Bridge Company, under contract, on a concrete foundation constructed by the railway forces.

Two double track ash-pits, forty feet long, were provided. These pits are twelve feet deep and so arranged that they may be operated as dry or flooded pits. They are constructed of reinforced concrete walls, lined with fire brick, with the sloping wall of steel rails under the tracks. The space between the two tracks, over the deep part of the pit, is covered with a wooden platform which is removed when the cinders are being taken out of the pits. The ashes are removed from the pits by a coaling crane with a clam-shell bucket. This crane is also used to load coal from storage piles or coal engines in case the plant breaks down.

Construction of Buildings

As all the buildings were required for operation at the same time, it was decided to carry on the construction of them simultaneously and thus prevent the work from becoming congested. For purposes of organizing a construction force, a fairly close estimate of the quantity of each class of work to be performed was made and from it an approximate estimate of the number of men and time required to perform each was obtained. By keeping in view the natural sequence of the work, a program was worked out by which the foundation work was kept well ahead of the concrete work, the concrete work ahead of the brick work, the brick work ahead of the carpentry painting, piping, etc., and throughout the whole work there was very little interference of one class of work with another, so that a gang once organized to perform certain classes of work was kept up to full strength until the work was practically finished.

Bills of material were also prepared, orders were placed for these as early as possible and arrangements made for delivery in accordance with the general programme of the work. By keeping daily records of material on hand, and by keeping the persons supplying the material

daily advised of the material situation at the work, no serious delay was caused for material, although in some cases the men had to be shifted to another part of the work for a few days. This was true in the case of the steel window lintels, reinforcing for the concrete floor in stores building, pipe fittings and electrical supplies. Notwithstanding this the general programme of the work was very closely adhered to.

Foundation Excavation

The material encountered in the foundations was all a stiff clay or hard pan, merging into rock, which made hand excavation very slow and expensive. As the site had been levelled to sub-grade the previous year, practically all the material from the excavation had to be hauled to the embankments as it was not suitable for filling near the surface, which made it very important that some mechanical means be obtained for loading it, especially where the quantities were large.

The back wall of the engine house and hot-air duct required a trench about eight feet wide and four feet deep, and contained about 1,600 cubic yards, nearly all of which was excavated and loaded on dump cars by the railroad ditcher, which was supported over the top of the trench by the same bridge stringers used on the sewers. The turntable-pit contained 1,950 cubic yards and was all excavated by the ditcher except the footings, which were cast out by hand, sufficient material having been taken out to permit this.

The excavation for the pits and pedestals in the engine house presented a difficult problem as these covered a large shallow area. An effort was made to excavate this with an orange-peel bucket, operated by the locomotive crane, but this was not successful the material being too hard. Finally the ditcher was used, but had the disadvantage of excavating a larger area than was required for the actual footings. A considerable amount of track shifting and shunting was entailed, but it worked out to be the most economical method available.

About seventy-five per cent of the excavation for the deep ash-pits was performed by the ditcher, the lower part of it was handled twice, the ditcher not being high enough to load the material into cars when lowered into the excavation to reach the bottom.

The foundation excavation for machine shop, power house, tank, and stores building, was all done by hand as the material, especially in the case of the latter, was required for backfilling in and around the building. The excavation for the coaling plant was partly done by teams with scrapers, partly by hand, and partly by the orange-peel bucket operated by the locomotive crane.

Concrete Work

The total quantity of concrete is about 5,300 cubic yards. Several methods of mixing and distributing this were considered, but as the concrete was practically all to be placed below rail elevation, and was distributed over a comparatively large area, it was decided to use small mixers, set up at convenient points close to the work, and so avoid transporting the concrete long distances. Two concrete gangs, consisting of foreman, mixer runner, and twelve to sixteen laborers, were organized, using two London gasoline mixers of six cubic feet capacity. The aggregate was all supplied on cars, and consisted of screened, washed gravel. The fine aggregate was from one-quarter inch down, the coarse aggregate was from one-quarter inch to two and one-half inches in size. For all foundations, piers and engine-pits, the concrete was proportioned: one part Portland cement, two and one-half parts fine aggregate, to five parts coarse aggregate. For the thin reinforced concrete walls of the main heating duct, the floor over the stores oil cellar, concrete window sills and lintels, a mixture of 1:2:4 was used. To waterproof the hot-well walls and floors, hydrated lime was added to the mixture, eight per cent of the weight being used. The material was put into the mixer dry, along with the other aggregates.

The site was such that the cars could be spotted close to the mixers, and the material, including the cement, wheeled directly from car to mixer, with one handling only. This effected a great saving in the cost of labor. The mixture was wheeled from mixer to forms with St. Clair carts of six cubic feet capacity, which were carried on plank runways at the elevation of the top of the forms. It was found that the London mixers were too small and a Smith one-half-yard steam mixer was substituted for one of them as soon as the heavier part of the concrete work, such as engine-pits, turntable-pits, etc., were reached. The small mixer did very efficient work on the outlaying buildings, but our experience was that the Smith mixer was the more efficient where the large quantity of concrete was required. The forms were made of two-inch dressed spruce in sections, so that they were used over and over again. In constructing the backwall and hot air duct about 300 lineal feet of sectional forms were built, and by taking these down and moving them ahead, the whole duct, over 1200 feet long, was constructed with the same set of forms. The same method was also used with pedestal forms, engine pit forms, etc. After removing the form it was cleaned and oiled before being used again.

The first concrete was poured on May 12th and by November 15th, the whole 5,300 cubic yards had been placed with the exception of a few odd jobs which were delayed waiting for material or other similar cause. In addition to pouring concrete, these gangs were used, especially that with the small mixer, in excavating foundations by hand, or other necessary work.

Brick Work

The brick work was commenced on May 26th as soon as the concrete foundation was ready to receive the same. At first a small force was employed, as the walls could not be carried above the top of the windows until the steel window lintels were received, which was on July 5th. After that the force was increased to twenty-six bricklayers, and maintained at that until the walls were up, on October 20th. Approximately 1,190,000 brick were laid, of which 400,000 were second hand brick from North Street station, Halifax. The remainder were new brick from Pugwash. Cement mortar consisting of three bags of cement, one bag (50 lbs.) of hydrated lime, with three-eighth cubic yard of Shediac sand, was used. For the first month this was mixed by hand, but after that a gasolene London concrete mixer was used. This worked out very satisfactorily, as the mortar was much more

uniform and was received by the bricklayers much fresher. Five men with the mixer had no difficulty in supplying mortar to twenty-six bricklayers, where twelve or more men had been required before.

Frame and Roof

The frame of all buildings, except the machine shop, were of British Columbia fir, most of which was received in April, and framing was proceeded with at once. Templates were made for each member of the engine-house frame, and resulted in saving a great deal of time, and in getting very uniform work and a good fitting frame. The frame for the coaling plant was also framed early, and erection commenced July 18th, as soon as the foundation was ready. For erection a 15-ton locomotive crane with 35-foot boom was used, and was a very great labor saver. This crane was used in erecting the second storey of the coaling plant, above which it would not reach, and the timber was erected by gin pole. The frame for three stalls could be erected from one track, and a foreman with eight men and the crane frequently did this in one day. After the frame was erected the crane also hoisted most of the sheathing to the roof, which was unloaded from the cars on the ground in sling loads, where it could be picked up by the crane.

The work of erecting, fixing joints, and bracing, went on almost continuously and was followed very closely by a gang of carpenters placing sheathing, smoke jacks, cornice and gutters; so that the roofing contractor, who came on the roof as soon as the first two sections were passed, worked continuously to the end of the work without delay. Erection of the frame was commenced on August 10th, and the crane finished hoisting roof sheathing on September 29th, having erected frame and roof material on the 40-stall engine house 89,500 square feet in area, during that time.

Heating and Piping

The foundations for boilers, air compressor and heating fans were poured at the same time as the foundations for the power house. The vitrified clay pipes connecting the hot air duct with the engine pits, were started just after the pouring of the pits, and followed around simultaneously with them.

Much of the equipment from the old power house including the two 250-horse power Babcock and Wilcox boilers, air compressor, piping, etc., was to be used in the new. As it was not possible to ascertain just how much of this equipment could be used again, and what repairs it would require, until it was taken down, this part of the work was commenced about July 15th. It was found that all tubes in the boilers required renewing, and that extensive repairs were necessary to the air compressor, and other equipment. The piping in the engine house was commenced as soon as the roof sheathing was well under way, and was continued around the building simultaneously with it. Considerable delay was experienced in obtaining some extra heavy special fittings for the steam and heating plant, but notwithstanding this the whole heating plant, air and water systems, were put in operation prior to the house being opened for operation. A total of 11,600 lineal feet of piping having been installed in the buildings.

Permanent Tracks

During the season 7.03 miles of permanent track with 43 switches were laid. This work could not be done continuously but the layout was located on the ground, and wherever possible service tracks were laid in the position of permanent ones. A large amount of old track had to be taken up and shifted, and the locomotive crane was very useful in handling this material.

Transferring from Old to New Facilities

It was necessary to continue operation at the old facilities until the new ones could be used. About one-half of the machines in the old shop were belt driven, and these were installed in the new shop, while the motor driven machines were left in the old shop until after the transfer had been made.

The transfer of the turntable naturally was the governing feature, this was accomplished without any interference with traffic. The table was put out of service at the old house at 8.00 a.m. December 17th, and was raised out of the pit without removing deck or rails, by a 75-ton wrecking crane, by a rather unique method. The crane lifted one end of the table, blocking was placed under the centre, the table was then tilted over the blocking and the opposite end blocked up. By repeating this several times the table was raised high enough to permit car trucks with especially constructed bolsters to be pushed under the table. By this means the table was transferred to the new site by 4.00 p.m., where it remained till the following morning. During the night the crane was taken away on other service, and it returned at 11.00 a.m. By reversing the tilting process the table was lowered into the new pit, and at 4.30 p.m. December 18th the first engine went into the new house.

The total quantity of various kinds of work performed is as follows:—

Excavation by steam shovel	158,000 cu.yds.
Trenching for sewers	4,960 cu.yds.
Trenching for water pipes	3,690 cu.yds.
Foundation excavation for buildings, ashpits, tank, etc.	12,670 cu.yds.
Concrete poured	5,315 cu.yds.
Brick laid	1,190,400 bricks
British Columbia timber	392,000 ft. B.M.
Other timber and lumber	1,025,000 ft. B.M.
Steel water tank	150,000 gallons
Structural steel	57 tons
Reinforcing rods	31 tons
Reinforcing rails	13 tons
Sewer pipes	3,683 feet
Cast iron water pipes	5,460 feet
Hot air pipes	2,350 feet
Wrought iron piping	11,600 feet
Stand pipes	4
Fire hydrants	5
Permanent tracks	7.03 miles
Permanent switches	43
Ballast and cinders	40,000 cu.yds.
Roof area	1,073 squares
Glass area (Approx. 10,000 lights)	8,300 sq. feet.

Automatic Box Car Unloaders For Grain

A description of the Unloaders installed at the Grain Elevator Plant of Canadian National Railways at Port Arthur, Canada.

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Paper to be presented at the General Professional Meeting, Winnipeg, Man., September 7th, 1922.

The necessity of having some form of automatic unloader for box cars conveying grain has evidently been under consideration from time to time for the past twenty years. This is shown by patents taken out but never developed into a complete machine which would meet all the requirements of both the railroad and the grain trade and at the same time do the work thoroughly and economically.

Before considering the design and requirements of an unloader, it is necessary to briefly visualize the transportation of the grain from farm to milling point, or in the case of export to some ocean port. In Canada, when we think of the many million bushels of grain produced in the Great West to be transported across the country and stored in grain elevators until required for consumption, the tremendous investments in rolling stock, terminal facilities, and grain elevators, and the important place which this problem has in the life of the people, it is easy to realize its national importance.

The grain is taken in trucks or wagons to the nearest country elevator where it is loaded into a box car, fitted with inside grain doors, and from there moved by rail to a terminal elevator where it is unloaded and the grain cleaned, sorted, and stored until ordered forward to a further point. Export grain may require to be handled through several elevators on account of being moved forward by both rail and water. The necessity of handling large quantities of grain in comparatively short intervals of time has brought about a very complete study of the methods employed inside a modern elevator, with the result that all manual labour has been eliminated, and the means of handling the grain have become automatic, and wherever possible, of the gravity type.

While handling methods inside the elevator have become very efficient, the unloading from box cars has, until the last few years, received very little attention, and the old manual methods of twenty years ago are still employed. Nearly all of this work having been done by means of a manually operated "Clark" power shovel. These shovels, generally operated in pairs, require two and sometimes three operators per car. The men employed on the work do so under very unhealthy and trying conditions. The physical exertion required is of a heavy nature, and the men are constantly enveloped in a dense cloud of grain dust. Their employment is by no means constant, and a good deal of the labour troubles experienced around the elevators is that caused by the shovellers. The earning power of the whole elevator is, therefore, dependent on the man power available for this work during rush periods, and also on their being continuously at work during the time that grain is being received.

A due consideration of the above conditions compared with the conditions one would like to see in general practice in this portion of the grain handling problem has led to the study of the possibility of using some type of mechanical and automatic car unloader, preferably of the gravity type.

Unloading Requirements

The following are the requirements of a successful box car unloader for grain:

(1) It must not damage the railway rolling stock, no matter how defective the condition of such rolling stock on arrival at the elevator.

(2) It must be designed to handle all types of box cars that may be received at the elevator.

(3) It must remove all grain from the car to the elevator pit without loss of grain and without hand labour.

(4) It should have means of removing the grain door quickly and without damaging same.

(5) It must be made practically foolproof in operation, and safe and reliable under all conditions of operation.

(6) It must have speed and economy of operation such as will more than justify its first cost.

(7) It must be served by trackage that will permit rapid handling of cars to and from the unloader without interruption to the unloading process over long periods.

Before considering the various types, let us picture a standard box car of grain with the usual side door and inside grain door which is usually nailed in, unless patent grain doors are used. In order to get the grain out of this car, the grain door has to be forced open, and if gravity is to be used, the car must be tilted either endways, or sideways, or both. Therefore, as tilting operations must be performed to empty the car, the most ready way is to run the car on to some form of rocking table or cradle, provided with end bumpers to keep the car from rolling off, and also with some form of mechanical door opener which will open and carry the door clear of the flow of grain. If we consider the shape of a box car with its long length comparative to its width, and with the door in the middle of its length, it will be seen that either or both side and end tilt would have to be made a good many times to empty the car of all grain, and consequently the cradle should be supplied with deflecting baffles which can be inserted in the car and avoid the side tilting operation, and also avoid an unnecessary number of end tilts.

Types of Unloaders

The various types which were under consideration before designing those in operation at Port Arthur were as follows: Trunnion live roller; knife edge suspension; rope suspension and rolling type. The relative advantages and disadvantages of side tilting, superelevation of the outer rail and the use of deflecting baffles without side tilt to the car, were also considered.

The trunnion and knife edge suspension types are comparatively cheap in construction as far as first costs are concerned, but would be liable to break down from wear and would be difficult to repair in case of such failure. The lubrication of heavily loaded trunnions presents some difficulty, and the maintenance of lubrication during periods of rest also entails a large degree of uncertainty. Further, if the point of suspension is kept below the base of rail, in order to keep the supporting bracket clear of the flow of grain, the out-of-balance moment when tipping to an angle of 45° causes a very heavy peak torque on the operating mechanism, and a correspondingly large motor is required. On the other hand, if the point of suspension is placed above the base of rail in order to reduce the out-of-balance moment, then the supporting bracket will interfere with the flow of grain, unless special rotating hoppers are introduced, these in turn providing additional complication.

A high virtual axis of rotation can be obtained by using a live roller support and a curved track; this, however, introduces a complicated track support, together with all the disadvantages attendant on live rollers, and a complex number of parts. Also, the axis of rotation would remain fixed and a good distribution of grain in the receiving hopper would not be obtained.

By side tilting the cradles or with a superelevation of the outer rail, it might be possible to do away with the deflecting baffles. This, however, causes very serious side stresses in the cars, for which they are not originally designed, and it is doubtful if sufficient side tilt could be given to the car to obviate the necessity of hand sweeping to thoroughly clean the car after operations were completed on the unloader. By inserting deflecting baffles, an angle of slope of 30° is made by the trough formed between the baffle and the floor of the car, when the car is tipped to 45° and the baffle inserted at 45° to the longitudinal axis of the car. Whereas in the case of a 15° side tilt the maximum angle of slope is only increased about 5° and along a plane of about 33° to the longitudinal axis of the car. The grain under these conditions being more likely to run down to the other end of the car than to flow out of the side door, as is required, with a minimum number of end tipping operations. The clearance required for side tilts also makes a wider spacing of trackage and housing necessary, and a consequent increased cost in construction.

Type Adopted for Port Arthur

The unloader adopted is of the rolling type, operated without side tilt but with deflecting baffles and an automatic door opener, which opens the grain door without damage and carries it clear of the outward flow of grain from the car. The rolling type was used because it is possible to obtain a higher virtual axis of rotation than with the trunnion type, and has not the possibility of breakdown and consequent delay which might occur with the use of live rollers or knife edge suspension. The higher virtual axis of rotation allows the unloader, whether empty or loaded with a full car of grain, to be in stable equilibrium. The point of support moving in a horizontal plane in the direction of rotation causes a less out-of-balance moment with a loaded car and a better distribution of grain in the receiving hopper than would obtain with the trunnion type.

The prime function of an unloader is its ability to efficiently handle all sizes of box cars in existence, or contemplated in the near future, which might be used at any time for the transportation of grain, and, in the design of the unloaders at Port Arthur, due consideration was given to the following: (a) Weight of all box cars and contents; (b) variation of length, width, and height of all box cars; (c) variation in elevation of floor of box cars, both when loaded and unloaded; (d) variation in width and height of grain doors.

The result of a thorough consideration of all these points is that the unloaders have been built to cover all possible variations in the above mentioned features of box cars, with the possible exception of a few freak cars.

General Description

The unloaders consist of a heavy structural rocking cradle, capable of being tipped with its longitudinal axis at a maximum elevation of 45° to the horizontal in either direction. This cradle carries the car of grain, and is provided with end locks to definitely support the end of the cradle while cars are being taken on and off, and with collapsible end bumpers to bring the car to a central position on the cradle, clamp the car in this position and take the total end thrust on the couplings of the car during the time the car is tilted at any angle to the horizontal in either direction. One side of the cradle is provided with heavy structural steel brackets which carry the door opening mechanism, two deflecting baffles, and baffle operating mechanism. Between these brackets and opposite to the grain door is a deflecting hopper or chute to insure the grain being carried well into the centre o

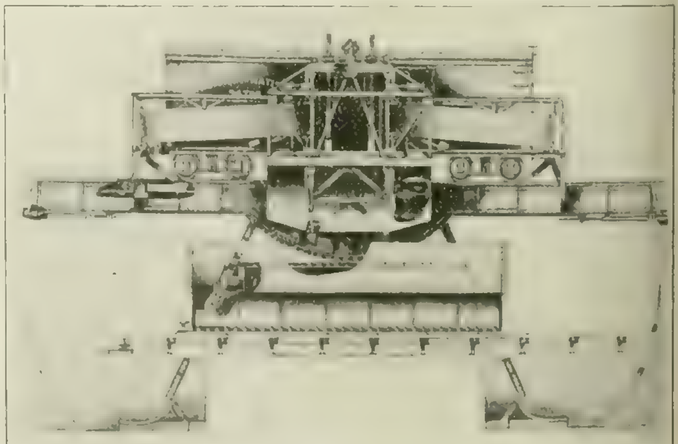

Figure No. 1. Automatic Unloader for Grain Cars.

the receiving hopper. Steel gratings are provided to protect the chute and to cover all the open spaces around the unloader. Flexible deflectors are also provided to prevent any spillage of grain along the side of the walls of the car, or in any manner except into the receiving hopper. A closed operating cab from which all movements of the unloader are controlled is placed in a fixed position opposite the grain door, and at an elevation from which all movements of the grain can be observed.

Cradle

The cradle consists of two heavily built web plate girders, having the lower portion at the centre formed into a circular tread which rests on steel cast tracks supported on a heavy concrete foundation. These girders are rigidly braced in a horizontal plane, and also at right angles to the axis to prevent side flexure, and to make the girders act together as a whole rigid tilting platform. The girders are designed to take a maximum loaded box car estimated to weigh 180,000 pounds, that is 60,000 pounds for the car, and 120,000 pounds for the grain; the girders being able to take this load with the horizontal axis tipped to 45° from the horizontal in either direction. The girders are also designed to take a 380,000 pounds locomotive when in the horizontal position and with the end pins in place. The circular tread at the bottom of the girder is made from heavy steel castings of a depth necessary to transmit the re-action over a sufficient length of web and also to take the load from the radial stiffeners down into the fixed tread. Heavy rolled plates were at one time considered for the circular tread, but were discarded on account of the possibility of a creeping action and consequent shearing of rivets due to constant reversal of rolling, as when using a thin plate the heavy concentrated load is liable to put a buckle into the plates between rivets, and during the tilting operation this buckle would be rolled forward across the plane of each pair of rivets holding the tread to the flange angles, and would in time cause the rivets to shear; the action taking place on each pair of rivets as the load passes over them, and being increased in effect due to the reversal which takes place in tilting in the opposite direction.

The fixed roller treads were designed with projecting lugs which roughly fit into corresponding holes in the rolling tread, these lugs being used to prevent the possibility of any slip between the cradle and the fixed tread during the tipping operation.

Tipping Machinery

The tipping machinery consists of a 75-h.p., wound rotor motor, equipped with a full torque solenoid brake, driving the main operating pinions through a worm and worm wheel, equalizing gear and bevel gears. Two pin-connected struts are fastened to the cradle, each having, respectively a rotating axis at a point beyond each end of the circular tread. These struts are equipped with cast steel racks engaging the main operating pinions. When tipping the cradle, the racks are subjected to a constantly changing velocity due to the variable point of rotation caused by the rolling action of the cradle on the fixed tread. The variable velocity of the racks, one with the other, necessitates the introduction of equalizing gears. These are of the spur pinion type, designed with three points of application equally balancing the load about the axis of the shaft, to prevent undue bending on the main cross shaft. The equalizing gear and worm gear are enclosed in an oil-tight case in order to obtain a high efficiency; the thrust from the worm being taken by ball thrust bearings. The efficiency of this mechanism is such that it is possible under load to drive the worm by pressure applied to the worm wheel teeth. The racks and struts are provided at the outer end with guides when in the lowered position, as at this time the yoke or carriage maintaining alignment between the pinion and the rack are at the upper end of the strut close to the connecting pins. The ends of the cradle are also guided by rollers at each end to assure an alignment of the track rails after tipping operations are completed.

End Locks

Four end locks are provided, each consisting of heavy steel pins, one at each corner of the cradle. The pins are pointed at the ends for easy entrance into the castings bedded in the concrete abutments, and are operated by a 5-h.p. motor through a screw and spur gear. They are designed to take the weight of a loaded car or engine coming on or off the cradle and give a final alignment to the rail in both the horizontal and vertical direction. They are interlocked with the bumpers or car clamps so that they cannot be withdrawn until the car is centralized on the cradle, and in the reverse, the bumpers cannot be lowered until the end locks are driven home; thus preventing any accident due to the possibility of running a car or engine on or off the unloaders, excepting when the cradle is supported at the ends by the four interlocking pins.

Bumpers or Car Clamps

The bumpers or car clamps are arranged so that the car does not have to be spotted in an exactly central position on the unloader, but can be pulled on the unloader into any position within two or three feet, and will be pushed into a central position by the bumpers. They are also designed so that practically any length of box car can be clamped in a central position on the cradle.

The clamps or bumpers at each end consist of two steel cast slides connected to a pair of tension and compression links capable of rising to the level of the car coupler and then travelling forward, forcing the car to a central position when the bumper at the other end will strike the coupler and clamp the car. The front slide, that is, the one nearest the transverse centre line of the unloader, is fastened to a wire rope coiled upon a drum, which is in turn clamped with a retarding torque sufficient to hold the slide in a fixed position. The rear slide, which is definitely operated by a screw, is, at the same time, lifting the tension and compression links to the required height. When this has occurred, the two slides come together and travel forward until the car is clamped at both ends. The slides are operated simultaneously at both ends by a single 10-h.p. motor operating the screws and travelling nuts through a pair of spur gears.

On account of the variable length of cars, the length of travel is *not* controlled by limit switches, but a slip

clutch is provided between the motor and gearing so that the motor can run after the mechanism has been stalled by the bumpers clamping the car at both ends; the clutch being supplied with a positive drive in the reverse direction to overcome the static friction of the mechanism when operating in the opening direction. The question of placing limit switches in parallel on the contact between bumper and coupler was at one time considered, but not installed due to the variable time element which would occur, in the operation of the switch, inertia of the rotor and application of the solenoid brake.

In applying the clamping device, as described above, to the couplers of the car, the component of the weight of the car and grain along the rails is taken on the coupler, which is designed for such loads. The bumpers were designed for a maximum load of 127,500 pounds and work very efficiently, allowing practically no end play when rocking the car.

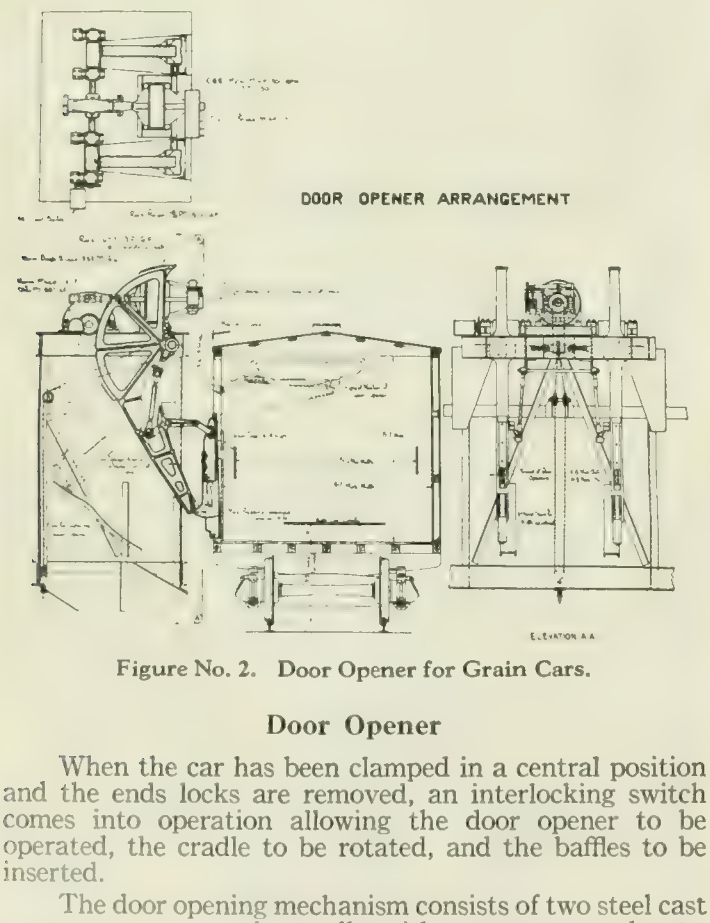

Figure No. 2. Door Opener for Grain Cars.

Door Opener

When the car has been clamped in a central position and the ends locks are removed, an interlocking switch comes into operation allowing the door opener to be operated, the cradle to be rotated, and the baffles to be inserted.

The door opening mechanism consists of two steel cast pressure arms, cast integrally with spur gear quadrants, pivotally mounted on trunnions and rotated by spur pinions from a common shaft driven through worm gearing by a 22-h.p. motor. Means are provided for adjusting the width of the pressure arms to suit the varying width of door openings and are arranged so as to strike the door as close to the door posts as possible. When the pressure arms first touch the door, their lower ends are kept above the elevation of the highest car floor and are so arranged that a slight pressure on the door releases a telescopic arrangement at the bottom of the arms allowing an extension to come down until it strikes the door sill. By this means the pressure is exerted over the total height of the door regardless of the elevation of the car floor and as close to the door posts as possible, thus avoiding any undue damage to the grain door. This, in itself, is quite an economy, as by the old hand method doors were invariably broken.

The opener enters the grain with an upward and inward movement, carrying the door above the grain toward the roof of the car and clear of the flow. The pressure of the grain against the door is released by the leakage of grain into the hopper, which occurs as soon as the smallest opening is effected, and the outward flow of grain allows an easy clearance space through which the door can be pushed. During this operation about 10 per cent of the grain in the car is discharged into the hopper.

Baffles

While the door is being held up inside the car by the opener, the cradle is tilted through an angle of about 20° and about another 25 per cent of the grain is discharged into the hopper, the remainder running down toward the other end of the car. The baffles are arranged so that they are tilted with the car and cradle, and while the car is in this position the upper baffle is inserted into the car as far as possible without crowding on the grain. The car is now tilted to an angle of about 40° in the other direction, when about another 50 per cent of the grain strikes the baffle and is discharged into the hopper. The baffle which is in the car, and which was in the upper position, is now in the lower and can be easily withdrawn. At the same time the other baffle, which is now in the upper position, can be inserted, and as only 15 per cent of the grain remains in the car, the baffle can be pushed forward over the floor of the car until the nose reaches the far side. The car is now tilted through the maximum angle in the other direction when the last remaining portion of the grain is emptied into the hopper and the cradle can be brought into the horizontal position and the baffle withdrawn.

The baffles consist of a pair of plated rectangular structural frames of right and left hand, having their faces at right angles to the floor of the car, and capable of being slid into the car so that the rectangular face or the trace of the plane of the baffle, is at 45° with the longitudinal axis of the car. As stated before, this gives a trough having an angle of slope of 30°, when the floor of the car is tilted to 45°. Down this trough the grain will readily flow out of the car. A wire rope attached to the front end of each baffle, passes round a grooved operating drum and thence to the rear end of the baffle, so that the baffle can be pulled in or out of the car by rotating the drum. The rear end of the baffle is guided at its upper and lower ends in tracks having a setting and curvature specially designed to keep the overall width of the unloader down to a minimum while the front end passes through a pivotted yoke so that the baffle is held in its correct location for any position in or out of the car.

The elevation of the front yokes, and consequently the front end of the baffle, is determined by a vertical driving shaft to which the operating drum is also keyed. The upper end of this shaft is of square section, and is driven by a 5-h.p. motor through a worm and worm gear. The lower end is threaded and screwed into a sliding nut supported in a definite location so as to take the unbalanced weight of the baffle when not supported by the car floor. The front end of the baffle is balanced by an adjustable counterweight acting through the lower yoke to relieve the pressure on the car floor.

At the time of entry, the baffle is at least three inches above the highest car floor, but as it is driven forward is lowered by the screw and nut until contact is made with the floor and the weight is relieved from the sliding nut, after which any further driving forward of the baffle only causes the sliding nut to travel up the shaft without altering the elevation of the yokes. The back end is flexibly retained in its tracks in such a manner that the lower edge of the baffle makes contact with the car floor along its entire length. To further prevent the escape of grain to the lower end of the car, a flexible canvas sealing strip is attached to the bottom edge.

To prevent the flow of grain from travelling too far down the baffles, along the baffle track, and out of the hopper, spring doors are provided to seal the entrance of the baffle and to close the opening when the baffle is fully withdrawn. Flexible, hand operated, deflecting baffles are arranged to prevent leakage of the grain along the sides of the car, and deflecting plates are provided under the car door to carry the grain well into the centre of the receiving hopper. Steel gratings are also provided to protect the fixed hopper and to cover all spaces around the unloader, as well as to catch any large foreign substances which might come out of the car with the grain.

Safety Features

Throughout the design of the unloader, the choice of type and the choice of method of operation were, to a large extent, governed by the desire to obtain a maximum safety of operation, and particular attention has been paid to features governing this requirement. The cradle is in stable equilibrium under all conditions of loading, so that should a breakage occur in the tipping mechanism, the car and cradle will come to a horizontal position without damage. All power transmission is made through self-locking worm or screw gearing, so that motion cannot take place unless it is so intended by the operator. The operations are electrically interlocked, so that they have to be carried out in proper sequence, and so ordered that damage cannot occur to either the car or the unloader. Limit switches are also provided, where necessary, for limiting the travel of each mechanism.

A completely closed operator's house is placed at a good elevation opposite to the car door, and is provided with glass windows so that the operator can, at all times, observe the process of unloading. The house contains the complete electrical control board, controllers, and resistances, so that the operations are under the direct control of the operator.

Electrical Interlock

When the unloader is in a position to receive cars, i.e., with the end locks inserted in place and the bumpers fully lowered, it is possible to get current to the bumper motors only and in the raising direction. With the bumper clamps raised and in the nearly home position, a normally open hatchway switch is closed allowing the end locks to be withdrawn. When these are fully withdrawn, a switch limits their travel and allows the operation of the door opener, rotation of the cradle, and insertion of the baffles, otherwise these motions are impossible. Three normally closed hatchway switches prevent the operation of the bumpers, end lock and door opener, either when the cradle is off the level, or when the baffles are inserted in the car. The door opener is limited in both directions by an L.S. 34, geared type, limit switch, which allows the operation of the bumpers and end locks when the door opener is in the out position only. The baffles and cradle rotation also have switches limiting their motion in either direction. The following is a list of switches giving conditions, type and duty:—

	Conditions	*Type*	*Duty*
1.	Baffles out and cradle level.	3 normally closed hatchway switches.	Prevent operation of bumpers, end lock, and door opener, if cradle is off level, or if the baffles are inserted.
2.	Door opener out.	L.S. 34 geared type (limits in both directions).	With door opener out, L.S. 34 allows operation of bumper and end lock.
3.	Bumper clamps fully lowered.	Normally closed hatchway switch.	Open when clamps fully lowered. Reverse operation only possible.
	(Above conditions allow car to be run on to cradle.)		
4.	Bumper clamps raised.	Normally opened hatchway switch.	Closes when clamps are nearly home, allowing end locks to be withdrawn.
5.	End locks withdrawn.	L.S. 20 XA.	Allows operation of door opener, rotation of cradle, and insertion of baffles (otherwise impossible).
6.	One baffle in.	4 normally closed hatchway switches (2 for each baffle).	Open singly at limit of travel of baffle in either direction allowing only reverse motion.
7.	Cradle rotates.	L.S. 34 geared type.	Limits rotation of cradle to 45° in either direction.

Time of Operation

The average time taken by the various operations in unloading a car of wheat is as follows:—

Raising bumpers and centering car	40	seconds
Withdrawing end locks	10	"
Opening door (10% of grain discharged to hopper)	15	"
Tipping cradle 20° to left without baffle (further 25% of grain discharged)	20	"
Insert baffle and tip cradle 40° to right (further 50% of grain discharged)	40	"
Withdraw right baffle, insert left, and tip cradle 45° to left, (final 15% of grain discharged)	50	"
Withdraw left baffle and bring car to horizontal	10	"
Withdraw door opener	12	"
Insert end pins	10	"
Drop end bumpers and inspect car	30	"
Complete time of operation	237	"
	(or about 4 minutes)	

The time taken to remove the empty car and spot a loaded car on the unloader platform depends, in a large degree, on the trackage layout. At the Canadian National Railways' elevator this occupies about three minutes, and the results obtained by observation show that where wheat is being unloaded, and no delays in distribution occur, it is easily possible to unload at the rate of eight cars per hour. When unloading oats, the time of operation is about one minute longer than that heretofore detailed, as the car requires at least one extra tipping of the cradle. Further, the time of operation over long periods of unloading is certain to be increased by delays incidental to distribution and other causes. Results, however, show that about 250 cars can be unloaded in a ten-hour day, on four unloaders at the Canadian National Railways' elevator, or an average of six and one-quarter cars per unloader per hour.

Power Consumption

As all of the auxiliary motors are of small capacity, and are only required to operate for a few seconds, twice during each cycle of unloading, their power consumption is of small moment. The tipping motor, operating for about two minutes during each cycle and being of 75-h.p., capacity is, however, a very important factor. The size of this motor was determined from the maximum out-of-balance load which could be obtained under the worst conditions of loading, viz: by assuming the largest possible amount of grain which could be left in the upper end of the car when tilted to the maximum elevation.

This was found to be equal to approximately double the normal torque of a 75-h.p. motor at the motor shaft, and as it only occurs momentarily, and then only under the worst conditions, a 75-h.p. motor was chosen for operating the tipping mechanism. After actual conditions of operation had been determined by trial at the site, and again assuming the worst conditions of operation with a maximum loaded car, a horse-power curve was calculated and plotted on a time base. This curve agrees with the original idea regarding power requirements, and further, it is found that the average power required over a complete cycle of tipping is about 40 h.p.

Economy of Operation

The average rate of unloading in an elevator equipped with multiple pits and having a pair of power shovels at each pit is about one car per hour for a ten-hour day. While the unloader has an unloading capacity of at least six cars per hour over the same period. The average unloading staff in a house equipped with a number of pits is approximately two men per pit, while on one unloader, an operator, one attendant and two labourers, a total of four men are required.

As one unloader will do the work of six hand pits, the saving of labour is represented by twelve men on the hand pits against four on the unloader, or a saving of eight men, and the monetary saving is in the same ratio, as the shovellers can be put on the unloaders as operators with very little training. Assuming a period of work during the year equivalent to the employment of the maximum staff for 200 days, the saving in labour will amount to 1,600 men-days. To convert this into dollars will of course depend on the rate of pay for this class of work, but assuming a rate of $5.00 per day, would amount to a saving of $8,000. per year per unloader. There is also a further saving due to the grain doors being removed undamaged. Maintenance costs are smaller than for an equivalent number of power shovels. The labour turnover and the danger of tieing up operation by strikes is naturally lessened on account of the very great improvement in working conditions. Power costs are rather less for one unloader than for six shovels. The initial cost of installation will, of course, depend upon conditions at different elevator sites, but will in many cases permit of a saving due to a less expensive trackage layout.

The question of the economy of installation in existing elevators is one which would have to be studied for each separate case by expert elevator engineers. The writer believes, however, that where a large volume of grain is handled that a study of the question would be well worth while and that unloaders can be installed to advantage in most existing elevators.

There is no doubt that grain car unloaders represent a marked advancement in the method of handling grain at this point in its transportation, and their application should be thoroughly considered, if only for the better working conditions which they give to elevator labour.

The unloaders were designed by the Dominion Bridge Company, Limited, in collaboration with C. D. Howe and Company, consulting engineers of Port Arthur, and were built and erected by the Dominion Bridge Company, Limited.

The Chemistry of Portland Cement and its Disintegration by Alkaline Ground Waters.

Professor T. Thorvaldson

Professor of Chemistry, University of Saskatchewan.

Paper to be presented at the General Professional Meeting, Winnipeg, Man., September 7th, 1922

The problem of the so-called "Action of Alkali on Concrete" is generally considered to be peculiar to the prairie provinces of Canada and the corresponding states south of the international boundary. There is no doubt that those regions of the prairies, having a low rainfall and poor drainage, present extraordinary conditions in respect to the amount of soluble salts present in the soil. The experiences of engineers in the dry belt of western Canada and the western states have indeed brought this problem very forcibly to the attention of scientists and the general public.

Analysis of the ground waters on the prairies indicate that high concentration of dissolved salts is fairly general both in the surface stratum and at lower depths. Shallow wells, and excavations for foundations of buildings, very commonly give seepage water having a concentration of one-half of one per cent up to even six per cent or more. In Saskatchewan, at least, water from deep wells, where a large supply of water under pressure is struck in the lower strata, has commonly total solids of one-half of one per cent.

Analysis of Water from the Prairie Provinces

The dissolved salts are, in general, mainly sodium, magnesium and calcium sulphates. Occasionally there is a large quantity of common salt present as well. Typical analysis of three waters taken near cement structures in the three prairie provinces follow:

	*Manitoba**	*Saskatchewan*	*Alberta*
		Parts per Million	
Total solids	20,022	16,010	18,492
Sulphate (SO_4)	14,180	11,090	12,153
Chloride (Cl)	440	331	trace
Carbonate (CO_3)	413	255	429
Calcium (Ca)	524	433	432
Magnesium (Mg)	2,560	1,771	607
Sodium (Na) (by difference)	1,948	1,863	4,505

Expressed in hypothetical combinations, as weight of each substance, in grams, per 100 cc.

	Manitoba	*Saskatchewan*	*Alberta*
Sodium sulphate (Na_2SO_4)	0.52	0.51	1.39
Magnesium sulphate ($MgSO_4$)	1.27	0.88	0.31
Calcium sulphate ($CaSO_4$)	0.08	0.09	0.03
Calcium carbonate ($CaCO_3$)	0.07	0.04	0.07
Sodiumchloride (NaCl)	0.07	0.05	trace
Total solids	2.01	1.57	1.80

In the above samples of Manitoba and Saskatchewan waters magnesium sulphate predominates, while in the Alberta water sodium sulphate is present in larger quantity. Waters of the latter type are also quite common in Saskatchewan. The differences in actual concentrations of these three waters are not significant as the seasonal variations of concentration are large.

*The figures for the Manitoba water are from analysis kindly supplied by A. Blackie, city chemist, Winnipeg.

Reasons Advanced for Failures in Concrete

Until lately all failures of concrete were attributed to defective concrete, the defects being supposed to have existed either in the cement or aggregate, or in the method of manufacture of the concrete. Perhaps the only exception to this was when some engineers considered that failures of concrete structures exposed to sea water were due to the salts in the sea. The best known of these failures was that of the dock at Aberdeen, Scotland, built in 1875, of which a description is given in the Proceedings of the Institution of Civil Engineers, in 1891. Other cases occurred at Hartlepool, Sunderland, Scarborough and Belfast where docks failed to stand up. Engineers, however, did not reach a unanimous opinion as to the causes of these failures. Some thought that the failures were due to a cement too high in lime, and that the magnesium chloride in the sea water combined with this. Others thought that the cause lay in too high a percentage of magnesia in the cement. In 1871 Dr. Michaelis, of Berlin, published a paper on "The behavior of Portland Cement in Sea Water", in which he stated that, "The salts contained in sea water, especially the sulphates, are the most dangerous enemies of hydraulic cements". In the case of the failures at Scarborough, investigation was made by B. D. Butler and the conclusion arrived at, that the damage was due to land water containing sulphates. He says, "Waters containing calcium or other sulphates are a serious source of danger to cement concrete exposed to their action, and they are liable to attack the cement and to cause deterioration, with, in extreme cases, disintegration of the mass".

While the evidence as to the cause of failures of concrete structures in sea water is very conflicting and in Great Britain, at least, the general opinion seems to be that well made structures of dense concrete will stand up indefinitely where they are constantly immersed in the sea,[1] yet there is no longer any doubt that well made concrete, manufactured from the best of materials, will not stand up long if in contact with such ground waters as the three of which analysis is given above.[2] In the case of dense concrete in contact with such solutions, the outer layer softens slowly and all cohesion between the cement and aggregate disappears. This action proceeds gradually inwards. Often the outside has a blistered appearance which is due to breaks in a

1. Deterioration of structures in sea-water. First report of the Committee of the Institution of Civil Engineers 1920. Page 273. Also Second (Interim) Report 1922, Page 10.

2. Wig. Williams, Finn etc. — Technologic Paper 95 U. S. Bureau of Standards. Also G. M. Williams, A.M.E.I.C., — The disintegration of concrete in Alkali soils, *J. Eng. Inst. Canada 4*, 446, 1921.

thin shell of calcium carbonate formed on the outside, while the damage proceeds beneath. If the concrete is porous, action will take place throughout the mass instead of proceeding gradually from the outside. In walls or floors made of such concrete where evaporation can take place; as for instance inside of a basement; incrustations, composed mainly of sodium sulphate, form. The salt solution penetrating the wall from the outside evaporates leaving the salts on the inside of the wall. This occurs also commonly on concrete structures just above the water line, at the surface of a damp soil rich in sulphates, or at the level to which the soil solution rises by capillary action. Thus while the water penetrating the concrete may not have a high concentration of sulphates, increase in concentration takes place through evaporation until the solution is saturated. On further evaporation incrustations of salts form on the concrete structure. This explains why "alkali" action usually appears first, in foundations of buildings, at the surface of the soil, or at the upper limit to which the soil waters commonly rise. The concentration of the salts in the water further down in the soil may be fairly low so that the action appears there later, or even may not appear at all if the concentration is too low.

Constitution of Cement

The question then presents itself as to the nature of the action of these salts on the concrete. Before one can inquire into this matter it is necessary to have a clear idea as to the nature of concrete. The part of the concrete which is acted on is the cement, and thus we have to study the constitution of cement before we can draw conclusions as to the action of salts on it. Before proceeding further it is therefore necessary to summarize briefly the work on this subject to date, especially the results of the work of P. H. Bates, A. J. Phillips and A. A. Klein of the United States Bureau of Standards,[3] and of E. S. Shepherd, G. A. Rankin and others of the Geophysical Laboratory of Washington.[4]

Perhaps the first definitely planned research on cement was carried out by John Smeaton in 1756 when he determined to attempt to find "the most perfect cement possible" for the building of the Eddystone lighthouse. He found that for mortar, to be used in water, the purest lime was not the best, but that the lime giving the best results was really chalk impregnated with clay. Pure lime would not harden under water while burnt clayey lime did harden. Thus he obtained a hydraulic lime mortar, which when mixed with pozzolana — a pumice-like material of volcanic origin — produced a satisfactory mortar for the lighthouse. While this may be considered the beginning of the cement industry, the material was not constitutionally, except in a slight degree, like Portland cement of to-day. The name "Portland cement" appeared first in 1824, when Joseph Aspdin, a bricklayer of Leeds, took out a patent for making a cement from limestone and clay; the name being taken because the set product resembled the stone quarried at Portland, England. This cement was burned at a low temperature without the formation of clinker which is formed by partial fusion. The hard product when formed by "overburning" was generally rejected, although it was more like the Portland cement of to-day. Later the value of the hard-burned product was recognized and the production of Portland cement, as we know it to-day, began shortly after the middle of the 19th century.

The pioneer work on the constitution of cement was done by a number of men of whom one might mention Bergman of Sweden, Saussure of Switzerland, and Vicat of France. The last named, who may perhaps be considered the founder of cement chemistry, explained the hardening of hydraulic lime by chemical action of the lime on the alumina and silica, while ordinary mortar made of rich lime and sand required carbon dioxide for hardening, and if excluded from carbon dioxide remained soft for a number of years. On the other hand rich lime mixed with finely ground pozzolana hardens in a short time in water, the lime and the pozzolana combining chemically.

In 1887 Le Chatelier[5] published a paper which is now a classic on the constitution of cement. The microscope and chemical analysis supplemented each other in his research. He concluded that Portland cement contains tricalcium silicate, tricalcium aluminate, "calcium ferrate", and "multiple silicates".

The work at the Geophysical Laboratory and the Bureau of Standards, Washington, indicates that the chief constituents of well burnt clinker of Portland cement are tricalcium silicate ($SiO_2.3CaO$), dicalcium silicate ($SiO_2.2CaO$), tricalcium aluminate ($Al_2O_3.3CaO$), and clay or glass high in oxide of iron, with 5.3 calcium aluminate ($5CaO.3Al_2O_3$) and calcium oxide as minor constituents. These conclusions have now been generally accepted.

Let us try to follow what happens during the burning of Portland cement, and instead of taking the usual materials let us begin with the pure oxides of calcium, aluminum and silicon in the proper proportion for Portland cement;[6] (say $CaO = 68.4$; $Al_2O_3 = 8.0\%$; $SiO_2 = 23.6\%$). While raising the temperature to 1,000°C we can consider that nothing happens, unless the lime was present in the beginning as calcium carbonate, in which case the carbon dioxide of the limestone would be evolved. Above 1,000°C the lime begins to combine with the silica to form dicalcium silicate ($2CaO.SiO_2$). The calcium oxide also combines with the alumina to form the 5.3 calcium aluminate ($5CaO.3AlO_3$), while there still remains a large excess of free lime. As one continues to raise the temperature some of this free lime combines with the aluminate to form tricalcium aluminate ($3CaO.Al_2O_3$). At 1,335°C flux, or molten liquid, first appears as this is the eutectic temperature for the system composed of the above three compounds, namely, dicalcium silicate, tricalcium aluminate, and 5.3 calcium aluminate. As the system is heated above this temperature a new reaction begins, the free lime combining with the dicalcium silicate to form tricalcium silicate ($3CaO.SiO_2$). The 5.3 calcium aluminate also combines completely with the free lime to

[illegible] ially Technologic Papers Nos. 43, 78, and 197 U. S. [illegible]

[illegible] s. 41, 202 and 218 of the Geophysical Laboratory, Washington.

5. Experimental Researches on the Constitution of Hydraulic Mortars — Trans. J. L. Mack.

6. G. A. Rankin — The Constitution of Portland Cement Clinker, J. I. E. C. 7, 469 (1915).

form tricalcium aluminate. At about 1,475°C the calcium aluminates have disappeared entirely into the liquid phase, while free lime, dicalcium silicate, and tricalcium silicate, remain in the crystalline condition; the last growing in amount rapidly at the expense of the two former. If kept above this temperature, but below 1,650°C the reaction will run to completion, the lime disappearing entirely and on cooling the charge crystallizes completely, giving a clinker approximately of the composition 45 per cent tricalcium silicate, 35 per cent dicalcium silicate and 20 per cent tricalcium aluminate. If instead of stopping at about 1,650°C the charge were heated above 1,900°C, the tricalcium silicate would dissociate into dicalcium silicate and free lime. If other substances, such as compounds of iron are present, as in the commercial burning of Portland cement, the flux appears at a lower temperature and complete burning will therefore take place at about 1,425°C with a corresponding change in the proportion of the main products present.

Properties of Main Components

We will summarize briefly the properties of these main components of normal Portland cement, as described by the experimenters mentioned above. ([3], [4] and [6])

Tricalcium Silicate — ($3CaO.SiO_2$). This compound is formed from dicalcium silicate and lime with alumina only above 1,335°C and is decomposed again when the temperature reaches 1,900°C. When mixed with water it has properties very similar to Portland cement, except that it is slightly less plastic. The plasticity is increased to that of Portland cement by the addition of 3 per cent plaster. The initial set is quicker than that of normal Portland cement. Briquettes made of this gain most of their strength within seven days and almost all in twenty-eight days. Tests on hydration show that most of this also takes place in the first seven days and almost all within twenty-eight days, giving a mass of very dense structure of gelatinous silicate interspersed with crystals of lime hydrate. Thus lime hydrate is formed during the hydration by the decomposition of the tricalcium silicate. Some of the most valuable properties of Portland cement are conferred on it by the tricalcium silicate which it contains, namely, those of setting within a reasonable interval, developing strength rapidly, and forming a non-porous dense mass.

Dicalcium Silicate ($2CaO.SiO_2$). This is a very stable compound as is seen from the fact that it is not decomposed at its melting point, which is about 2,130°C. When kneaded with water it has no plasticity and gives no true set. When in contact with water for two to three weeks it hydrates and hardens slowly, small amounts of lime being formed. It is thus much more stable than the tricalcium silicate in respect to water. In three to four months it has gained as great strength as the quicker setting tricalcium silicate. It has then a sandy structure containing voids or cavities in which water may freeze or salts crystallize, with attendant strain due to the physical forces of freezing or crystallization.

Tricalcium Aluminate ($3CaO.Al_2O_3$). This substance hydrates almost instantaneously with great evolution of heat, and gives a "flash set" which is due to its agglomeration into masses with the hydrated material on the outside, preventing further hydration of the inside of the mass. On further addition of water the mass becomes plastic and does not again set or harden. A large amount of water is required for complete hydration, and the mass remains quite plastic for a long time.

It may seem peculiar, considering the apparent inferiority of the dicalcium silicate and the tricalcium aluminate to pure tricalcium silicate, that the last named is not used instead of Portland cement. Without going into details one can state that the reason is mainly one of cost, the pure tricalcium silicate not being obtainable at commercially practicable temperatures. Furthermore, tricalcium silicate is found as a primary phase only within the ternary system and alumina is the most convenient substance to use for this purpose. Then there are probably indirect advantages on account of the presence of tricalcium aluminate. Through its property of rapid hydration it assists in breaking up the particles of finely ground clinker. Its presence seems to speed up to a slight extent the hydration of the silicates. Furthermore, in the presence of free lime the aluminate is not so active with water and acquires some cementing qualities. The substances containing the iron and magnesia are not active and probably play no part in the hydration of the cement.

Process of Hydration

One may summarize the process of hydration of Portland cement thus: The tricalcium aluminate hydrates first and the physical disintegration taking place assists in the hydration of the silicates which follows. At first amorphous hydrated tricalcium aluminate is formed but this later crystallizes. Any small amount of free lime present hydrates and reacts with the aluminate, producing cementing effect. The next substance to react is the tricalcium silicate and the hydration of this is well advanced in seven days. After this comes the crystallization of the hydrated aluminate and the hydration of the dicalcium silicate. Thus early strength, (within twenty-four hours), is probably due to hydration of the aluminates and lime, the increase in strength up to seven days due mainly to the hydration of the tricalcium silicate, and the later increase in strength due mainly to the hydration of the dicalcium silicate.

Action of Alkali Ground Waters

How can we apply these facts to the better understanding of what happens when alkali ground waters act on set Portland cement. Experiments on the preparation of concrete using water containing a high concentration of alkali salts indicate that the early development of strength through hydration is not interfered with. Cement briquettes will develop nearly full strength when cured in sulphate solutions of a concentration which later causes disintegration. Thus the alkali disintegration seems to be so slow in its action that the effect on the fairly rapid process of hydration is not noticeable. It is, therefore, likely that the action of the alkali is on the products of hydration of the chemical compounds in cement clinker. These products are some crystalline,

some colloidal, and some present in condition sometimes described as solid solution. A variety of different chemical, colloidal and physical effects may, therefore, be involved in the process of disintegration.

Work done at the Bureau of Standards, Washington,[7] the Montana Agricultural College,[8] and at the Universities of Wyoming[9] and Saskatchewan, has brought out certain facts as to the chemical changes which take place when concrete disintegrates in solutions of sulphates.

(1) The simpler silicates, in general, when treated with water hydrolyze, the water becoming alkaline and the solid becoming richer in silica.

(2) During the hydration of the calcium silicates present in Portland cement, hydrated lime is formed with hydrated silicates of higher silica content.

(3) If the hydration takes place in pure water, in a system of limited capacity, equilibrium is soon attained and this prevents further extraction of the hydrated lime from the concrete.

(4) When water in contact with the concrete contains temporary hardness or carbonates, the hydrated lime reacts with this, forming a shell rich in calcium carbonate on the surface of the concrete.

(5) When water in contact with concrete contains sodium sulphate in solution the sulphate is removed from the water, and the water develops caustic alkalinity.

(6) When water in contact with concrete contains magnesium salts as well as sulphates in solution, both the magnesium and the sulphate are removed from the water while the water remains nearly neutral.

(7) The hydrogen ion concentration of solutions of sodium sulphate in contact with hydrated cement does not vary with change in concentration of the sodium sulphate while the total alkalinity varies considerably.

(8) The hydrogen ion concentration of solutions of magnesium sulphate, or mixtures of sodium and magnesium sulphates in contact with hydrated cement, varies with the concentration of the magnesium sulphate present and, in general, in the same direction as the total alkalinity.

From these it is possible to decide *in part* what chemical reactions take place during the action of sulphate solutions on cement and concrete. The free lime produced during the hydration of the calcium silicates in the cement has a slight solubility in water. On account of the low solubility and the consequent tendency to attain equilibrium in a thin film of liquid on the surface, the extraction of hydrated lime from cement by pure water is slow. However, fair-sized crystals of hydrated lime may form on the surface of briquettes stored in distilled water. This leaching out of hydrated lime progresses most rapidly in the case of cements high in tricalcium silicate, while cements in which dicalcium silicate largely predominates are not so active. This statement holds in practice only for specimens of equal permeability to water, and since dicalcium silicate, after setting, is much more porous than tricalcium silicate this advantage of the lower silicate disappears in practice. If bicarbonates or carbonates are present in the water these react with the hydrated lime forming insoluble calcium carbonate which may form a protection against further removal of lime and a partial protection against the action of sulphates from the outside. However, this protection is usually quite inefficient, at best, delaying the sulphate action somewhat.

When sulphates are present in the water, in contact with the concrete, the conditions are entirely changed. The calcium of the hydrated lime reacts with the sulphate radical and calcium sulphate is formed. The solubility product for this substance is low, and the presence of a large concentration of the sulphate ion will therefore render it almost insoluble. It separates out of solution as the hydrated form of gypsum. The removal of the calcium from solution in this manner upsets the equilibrium between the dissolved and solid hydrated lime and speeds up the leaching out of this substance from the cement, while the moment it enters solution the calcium continues to be precipitated as gypsum. If the sulphate present is sodium sulphate, the liquid attains thus caustic alkalinity, while the sulphate disappears as gypsum into the solid phase. On the other hand, if magnesium salts are present as well as the sulphate, the hydroxyl ion is removed as magnesium hydroxide, and the liquid remains nearly neutral, while both the magnesium and the sulphate radicals disappear from the solution and enter the solid phase. Thus the presence of dissolved magnesium salts and sulphates in water which is in contact with cement or concrete, produces ideal conditions for the constant removal of lime from the lime silicates in the cement with the consequent weakening of the concrete and when carried to completion final loss of all cementing properties.

The theory that the disintegration is due to the physical forces exerted during the crystallization of gypsum in the voids in the concrete can hardly stand as a sole explanation. The amount of free lime in properly manufactured set cement is small and the combination of this amount with sulphate could not explain the observed effect. Continued extraction of lime is necessary and suitable conditions for this process are produced by the presence of sodium and magnesium sulphates. This alone is enough to cause the weakening of the concrete and loss of the cementing qualities of the silicates. The crystallizing of the gypsum no doubt contributes to the final results by causing fissures in the weakened concrete and thus facilitating the access of the harmful sulphate waters to the interior portions of the concrete.

One must not draw the conclusion that the above statement explains everything about the disintegration of concrete by sulphate waters. There probably are other contributing factors. There can be little doubt that the process described above can by itself cause complete disintegration of lime silica cements. But there may be contributing factors which, if excluded, would cause a slowing up of the action to such an extent as to lose its seriousness. At present the only remedy known is the manufacture of concrete of low permeability and high strength, and this is only an expedient for lengthening the life of the structure. The only certain remedy is the exclusion of sulphate waters of high concentration from contact with the concrete and tried, cheap, efficient means for this are not available. Substitution of the calcium aluminates possessing cementing qualities in place of the calcium silicates has led to the development of the so called "electric cement" and "ciment fondu" but further work is necessary before one can determine the resistance of these to the action of sulphate waters.

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7. Bates, Phillips and Wig. — Action of the Salts in Alkali Water and Sea Water on Cement. Technologic Paper No. 12 U. S. Bureau of Standards.

8. Burke and Pinckney — The destruction of Hydraulic Cements by the Action of Alkali Salts. Bulletin 81, Montana Agric. Coll. Exp. Station.

9. Karl Steik — The effect of Alkali upon Portland Cement. Bulletin No. 113, University of Wyoming Agric. Exp. Station.

Turbines for the Great Falls Development of the Manitoba Power Company

Some Special Features of the 28,000-h.p., I. P. Morris Turbines being installed in this Plant.

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The object of this paper is to supplement the description of the new hydro-electric development at Great Falls, presented at this meeting by F. H. Martin, M.E.I.C., by pointing out a few of the special features of the I. P. Morris turbines for this plant, which are now nearing completion in the shops of the Dominion Engineering Works, Limited, of Montreal; also to use these turbines as an illustration in describing in a general way some recent notable advances in water wheel design for medium and low heads.

As most of you are aware, the tendency in the hydro-electric field during recent years has been towards larger and larger units of the vertical-shaft, single-runner type. This has been made possible by the development of the direct connected hydro-electric unit and the satisfactory solution of the thrust bearing problem. With this type of unit, operating under medium and low heads, the question of speed is, for economical reasons, very important. Higher speeds mean smaller and more efficient generators, lighter overhead construction, and smaller power-house cost. The limit of speed obtainable for large capacity units under low heads has been and still is determined by the limits of turbine development. However, great progress has been made by turbine designers within the last few years, and the most striking example of progress is to be found in the new development of the Manitoba Power Company.

Until quite recently the standard turbine runner for low head installations has been the Francis mixed-flow, i.e., inward- and downward-flow, type. With this type of runner specific speeds around eighty English units have been in use for some time with high efficiencies. Beyond this point, however, progress has been very slow until the recent development of a new type high speed runner, generally known as the "propeller" type, — its name resulting from the close resemblance it bears to a marine propeller. It has three to six vanes mounted on a central hub, and is usually unshrouded, i.e., there is no surrounding band. The new units at Great Falls are to be equipped with this new propeller type of runner.

Turbines at Cedar Rapids Plant

To illustrate the advantages of the high speed wheel and to point out more clearly some other features of the Great Falls turbines, a comparison will be drawn with the 10,800-h.p., units in the Cedars Rapids plant of the Montreal Light Heat and Power Consolidated. These units are also of I. P. Morris design and, when installed about eight years ago, were of the highest speed type then available. Figure No. 1 shows a sectional elevation of one of these units, the largest from point of view of actual dimensions now in operation. It will be noted that this unit is of the vertical-shaft, concrete-casing type, equipped with a Francis mixed-flow runner. The incoming water flows around the spiral casing, through the stationary vanes of the speed ring and the movable guide vanes, and strikes the outer portion of the runner vanes while still moving in a horizontal direction. In passing through the runner the flow changes from radial at inflow to axial at discharge, that is, neglecting the whirl components of velocity.

These Cedars units, as originally designed, have a rated horse-power of 10,800 and operate at 55.6 r.p.m., under a normal head of 30 feet. The last two units installed were increased in capacity to 11,300 h.p., by cutting back the outflow edges of the runner vanes. On account of the low speed, the generator, as you will note from figure No. 1, is of a very large diameter. The outside diameter of the stator frame is about 37 feet 4 inches, and the flywheel effect of the generator rotor 31,000,000 pounds-feet squared. This means high generator cost.

The runners of these units have a throat diameter of 182.75 inches, and on account of their large size were made in four cast iron sections, held together at the top by a cast steel crown plate, and at the bottom by a cast steel band. Each section contains four vanes. The result is a very heavy and expensive runner, the total weight being about 175,000 pounds. The speed ring, which stays together the concrete above and below the spiral casing and takes the downward thrust of the generator and surrounding concrete, is of the solid type with vanes cast integrally. The total weight of the bare

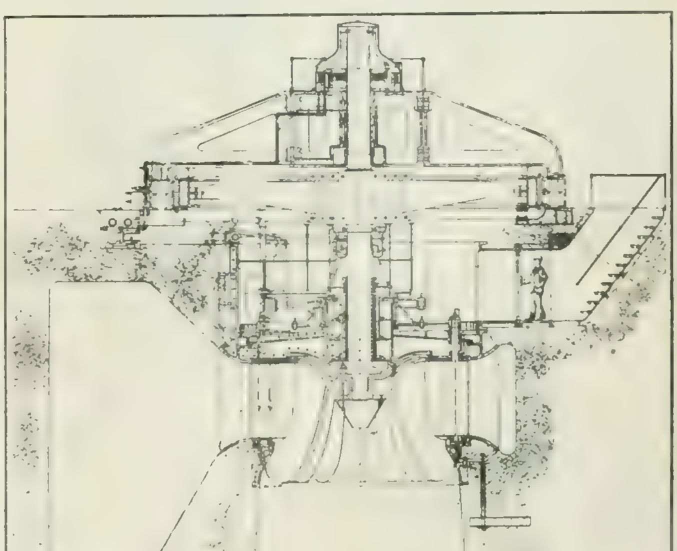

Figure No. 1. 10,800 h.p. Turbine in Cedars Rapids Plant of Montreal Light Heat and Power Consolidated.

turbine, not including governing mechanism or pumping system, is about 1,000,000 pounds. The draft tubes for the Cedars units are of the curved type, which at the time of installation was generally regarded the best to use when a straight tube would require too much costly excavation.

Great Falls Turbines

Let us now consider the new 28,000-h.p., units which are being installed by the Manitoba Power Company. These turbines will develop this power when operating under a head of 56 feet, at 138.5 r.p.m., as compared with 75 r.p.m., using the Cedars type of runner. The Cedars units, as originally designed, would develop about 27,500 h.p., and the last units installed in that plant about 28,800 h.p., under the higher head of 56 feet, so that a comparison with the Manitoba units is a fair criterion of the relative merits of the types of runners used in the two installations.

Figure No. 2, shows a sectional elevation of the Great Falls turbine and draft tube with an outline view of generator, thrust bearing, and direct connected exciter. The most striking variations from the Cedars units lies in the design of runner, speed vanes and draft tubes, and

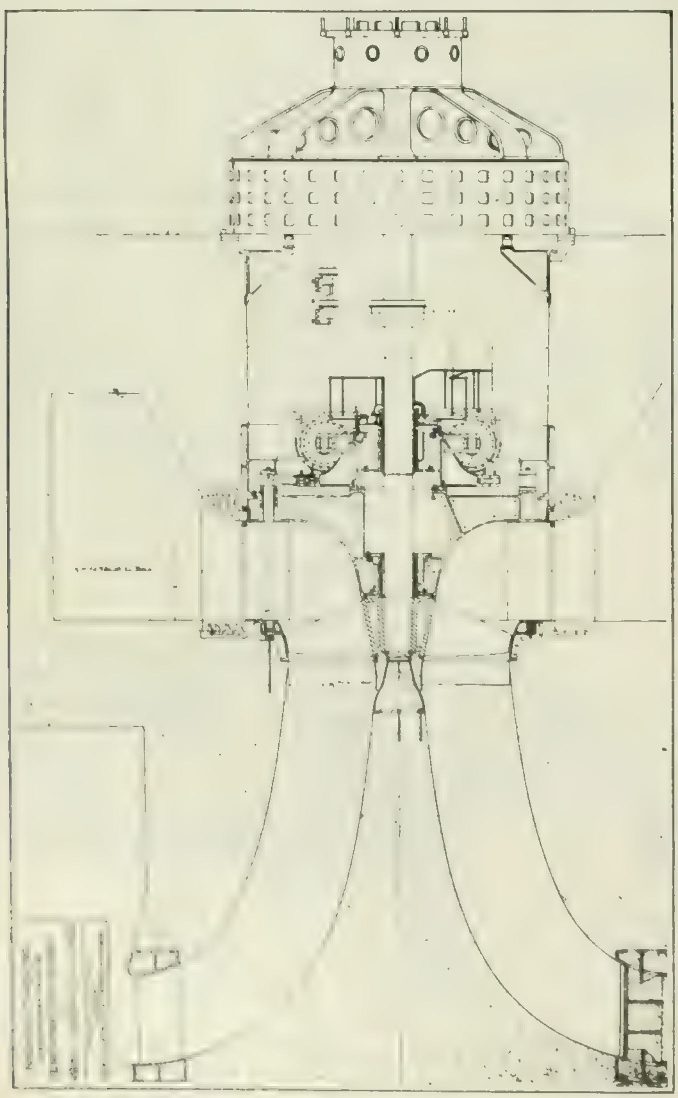

Figure No. 2. 28,000 h.p. Turbine for Great Falls Plant of Manitoba Power Company.

the dimensions of the generator. In this turbine there is a much larger whirl chamber between guide vanes and runner vanes. The runner is of the Moody diagonal type in which, neglecting the whirl velocity as before, the flow is diagonal at intake and axial at exit. The speed of revolution of this runner is remarkable, — the circumferential velocity of the vane tips being about 7,000 feet per minute, nearly twice the spouting velocity of the water for a head of 56 feet. As shown in figure No. 2, this high speed results in a much smaller generator than for Cedars. The outside diameter of the stator frame being only 24 feet and the flywheel effect of the generator rotor 18,000,000 pounds-feet squared. The higher speed also allows the use of a direct connected exciter, whereas separate water wheel driven exciters are used in the Cedars plant. There is no solid speed ring for this unit. The speed vanes are cast separately, the ends being imbedded in concrete and anchored by foundation bolts. The draft tube is of the Moody spreading type with central concrete cone running up to the runner, and with supporting cast iron vanes for the surrounding apron.

The very simple construction of the propeller type runner as compared to the Francis type, is shown by figure No. 3. The outer band is eliminated, and the runner vanes have very little curvature, thus cutting down the liability of corrosion. The number of vanes is only six as compared with sixteen for Cedars. This means much wider space between vanes, and little danger of clogging from ice or debris. The intake racks also may be spaced wider in proportion.

The throat diameter of the Great Falls runner is slightly greater than for Cedars, being 189½ inches, but the overall height is only 4 feet 5¼ inches, as compared with 11 feet 9 inches for Cedars. It is made of cast steel in one piece, and the estimated weight is 65,000 pounds, less than half the weight of the Cedars runner. Another advantage of this type of wheel is its great mechanical strength on account of the longer connection between vanes and hub, and the little overhang of the vanes as compared with the Cedars type. The separate speed vanes furnished with these units represent a new style of construction used here for the first time. These vanes are built in with the forms for the concrete, and securely anchored by long foundation bolts. Lugs are cast on the vanes at the top and fitted with adjusting screws for the proper setting of the pit liner with relation to the draft tube ring. This construction means a considerable saving in material and machine shop labour but, on account of the greater erection cost, it will probably only find application in large units of the type under discussion.

The heaviest casting for this unit is the head cover, which is supported by the pit liner, and in turn supports the lignum vitae bearing for the main shaft. It is built in halves on account of its large size. Its lower surface takes a cone shaped form to conform with the flow lines of the water. The forged steel shaft for this unit is slightly smaller than for Cedars even with the much greater horse-power, its diameter being 24 inches, compared with 25 inches for Cedars. The cast steel guide vanes are the largest yet constructed, their height being 7 feet 1¾ inch and width 4 feet 7 inches. They are fitted with separate stems which rotate in bronze bushed bearings in the distributor plate and head cover, and are connected by levers and double acting shearing links to the cast iron operating ring. The shearing links are so constructed that in case of any obstruction lodging between two

guide vanes when the gates are closing, or guide vane and speed vane when the gates are opening, the connecting link will shear before any damage is done to the rest of the mechanism.

There are other special features of these units which should be mentioned. The guide vane bearings are assured of an ample supply of grease at all times by the use of the Taylor pneumatic greasing system. With this system an air operated grease gun is supplied for each unit with the necessary piping to give a separate lead to each bearing, so that each bearing may be greased independently by opening a plug cock. The high pressure used ensures adequate lubrication with a minimum of operating labour.

Another feature is the automatic method used for changing from governor control to hand control, or vice versa. This is effected by the use of hydraulically controlled needle valves in the governor pressure and exhaust lines, instead of the old type with gate valves. With the old arrangement two or three men were needed to change the control, but with the new device one man can do so with ease.

The bypass and receiver provided on the governor pressure system is also worthy of mention. This consists of a needle valve discharging a certain quantity of water at all times into a cylindrical receiver connected with the sump tank. The object of this device is to allow constant operation of the pumps without overheating. There is circulation of water through the pumps at all times and the pressure rise is considerably less on account of this bypass.

The total weight of one of these turbines, exclusive of draft tube vanes, governing mechanisms and pumping system, is about 630,000 pounds. This reduction in weight from the Cedars unit is largely due to the new type of runner and the separate speed vanes.

Special Type of Draft Tube

Of late years there has been a growing realization of the importance of draft tube design, particularly for low heads where the velocity head at discharge from the runner is a large percentage of the total head on the plant. For the Great Falls units this percentage is about 30 at full gate, assuming an angle of whirl of 30 degrees, so it is at once evident that an efficient draft tube is highly important. The spreading type of tube with central cone, as developed by Lewis Moody of the Wm. Cramp and Sons Ship and Engine Building Company, is being installed for these units. This tube is constructed on the principle of an inverted vortex. You all have noticed the action of water flowing out through a hole in the bottom of a circular basin, how the velocity of whirl increases rapidly towards the center, and how the surface takes a curved form with a central space running down through the orifice. The action of the water flowing through the Moody tube is just the reverse of this vortex flow. Both the axial and whirl components of velocity are regained as the water moves down the tube until the lower velocity permits the turning of the water towards the tail race without undue loss. The ability of this tube to regain the whirl components of velocity gives it a decided advantage over most other types. The central cone conforms to the natural flow lines of the water, as determined by the outer surface of the tube, and eliminates the tendency to form a central vacuum, which would cause upward eddies in the central portion of the tube and loss in efficiency.

The questions of unit spacing and depth of excavation allowable, are important factors in determining the exact shape of draft tube and water passages. In this installation the unit spacing is somewhat restricted so that the depth of draft tube and surrounding water passages is greater in proportion. The overhanging apron is supported underneath by eight cast iron draft tube vanes. These vanes are so shaped as to assist in turning the outflowing water towards the tail race. They are designed to support the total superimposed weight of turbine, generator, concrete and water in the casing. Their use means a great saving in the cost of concrete reinforcing.

No paper on this type of hydraulic turbine would be complete without reference to the engineers who deserve the chief credit for its development. In Europe, Robert Dubs of Switzerland, and Victor Kaplan of Austria, have developed high speed runners of this general type. The Dubs runner is shrouded, while the Kaplan is unshrouded. In America, Forrest Nagler of Milwaukee, and Lewis Moody of Philadelphia, have each developed high speed unshrouded type runners. The Nagler runner is of the strictly axial flow type, while the flow in the Moody runner is diagonal at intake and axial at discharge.

The turbines at Great Falls will be equipped with the Moody type of runner designed by the Wm. Cramp and Sons Ship and Engine Building Company of Philadelphia. This company, in keeping with its past reputation for high class design, based on an abundance of experimental data, have gone to a great deal of trouble

Figure No. 3. Comparison between Propeller and Francis Types of Turbine Runners.

and expense in developing the new type of runner. In their modern hydraulic laboratory at Philadelphia, an exhaustive series of tests was carried out, using a 16-inch diameter wheel operating in an open flume setting. The turbine is direct connected to a hydraulic friction brake and dynamometer scales and the quantity is measured over a carefully calibrated weir. By means of an electric clock and bell system the various observers take readings simultaneously. Each individual run is of two minutes duration with readings taken every fifteen seconds. By a simple device for changing the angles of and the number of the runner vanes, each shape of vane tested was given a most thorough tryout. In conjunction with the runner tests, a careful investigation was made to determine the best arrangement of draft tube.

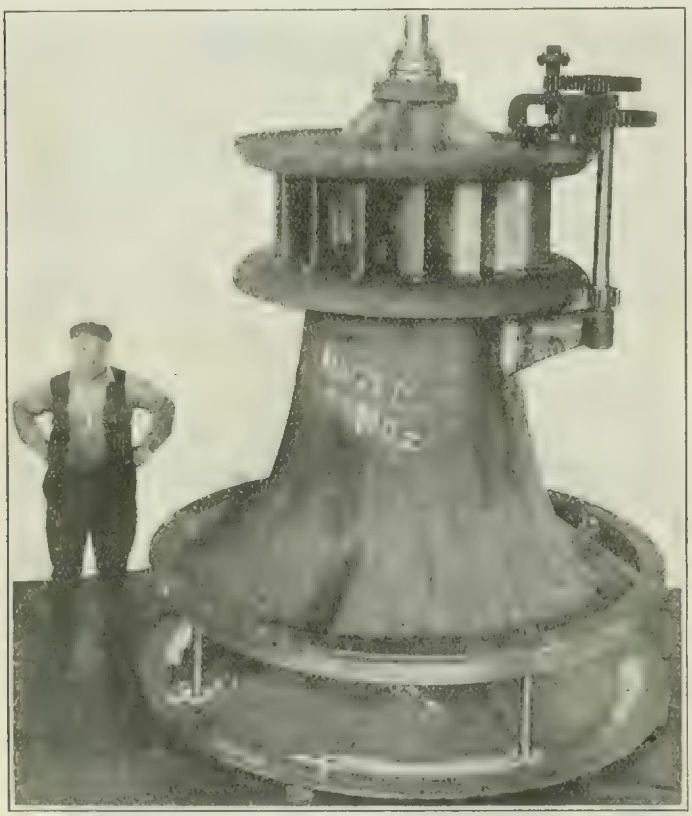

Figure No. 4. Manitoba Model Turbine for Holyoke Test.

Results of Tests

After a considerable number of runners had been tested, the three which showed the best results were picked out for test at Holyoke. A 35-inch model was then constructed and tested at Holyoke. Figure No. 4 shows an assembly view of this turbine. It is of the open flume type and is fitted with Moody draft tube and cone of cast iron exactly homologous to the Manitoba draft tube. The propeller type of runner shown in figure No. 4 is the 35-inch Holyoke model of the runner which was chosen as the most suitable for the Great Falls installation. This runner gave a maximum efficiency of 88.5 per cent at Holyoke.

A comparison of the horse-power efficiency curves for the Cedars model and some Moody model runners is shown by figure No. 5. These curves are plotted from the test results of the 16-inch experimental turbines, and so the efficiencies shown are considerably less than obtained at Holyoke, for which official results are not yet available. The dotted curves are for the Cedars model runner with curved and Moody draft tubes. This runner gave a maximum efficiency of 90 per cent on Holyoke test. It will be noted that the Moody tube gives a considerable increase in efficiency at part gates. The Moody tube also gives an appreciable gain in maximum power, showing about 7 per cent over the curved tube in this test. The full curves are for Moody high speed runners at specific speeds of 110, 125 and 153. As the speed increases the part gate efficiencies fall off appreciably. This, of course, is a big disadvantage for installations with a small number of units when the load is variable. However, with the increasing tendency to link up such small stations with others in the vicinity, this point becomes of small importance. Also, by going to a somewhat lower speed, very good part gate efficiencies may be obtained, as shown by the curves for model No. 81, and a considerable saving in cost will be effected as compared with the Francis type turbine. This model, No. 81, gave an efficiency of about 91 per cent at Holyoke.

The results of these tests have been most satisfactory, and as a consequence, it is safe to say that turbines of specific speeds up to 160 can now be built with maximum efficiencies comparable with the lower speed Francis type turbines. This means that many low head water power sites, which heretofore have been regarded as out of the question on account of the high initial cost, may now be developed on a commercial basis.

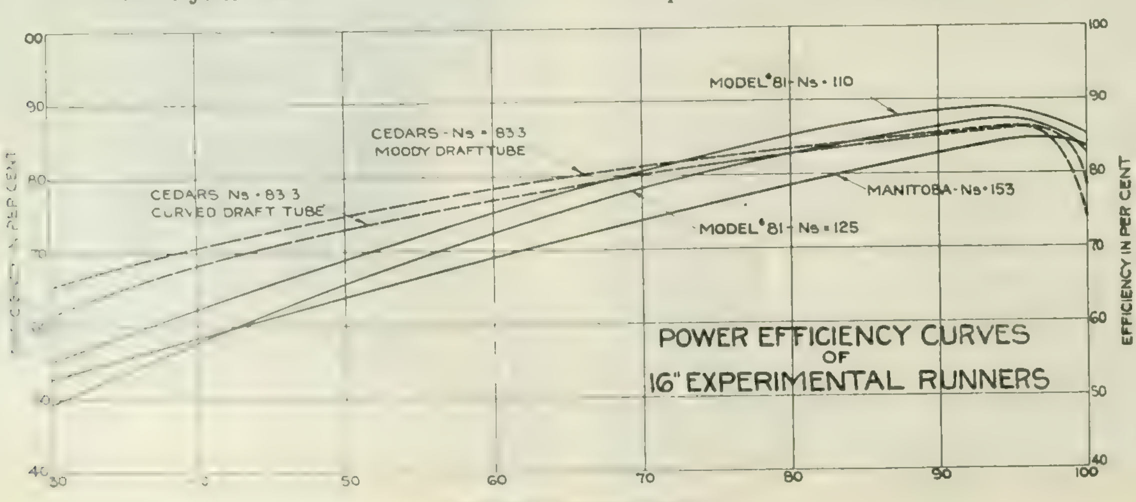

Figure No. 5.

Some Fallacies in Concrete Proportioning Theories.

A Review of Present-day Practice and Theories of Proportioning the Aggregates of Concrete.

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Professor of Civil Engineering, University of Saskatchewan.

Paper read before the Saskatchewan Branch, The Engineering Institute of Canada, at Moose Jaw, Sask, July 14, 1922.

During the past twenty years concrete has taken its place as one of the most useful and important of structural materials. Owing to the comparative ease with which it can be molded into any desired shape its structural uses are almost unlimited and its characteristics have resulted in its displacing older materials for certain classes of work wherever Portland cement can be obtained and suitable aggregates are available. The apparent ease with which concrete can be prepared has not confined it to use under the supervision of engineers as is the case of some types of engineering materials, but we find it employed by everyone who feels that the material is suited to his particular purpose. In many cases where proper skill is not at hand, concrete is little more than a bulky, heavy substance, lacking in great part the strength and other properties which should be attained, and often failing to fulfill the purpose for which it is intended.

To most users of cement who obtain such results, concrete is merely a shoveled-together mass of cement, aggregate and water which in a short time attains a certain degree of hardness and strength. To the engineer and skilled user who is more or less familiar with the many factors and variables which enter into its manufacture, the process of concrete making does not appear quite so elementary or so certain of results. Experience soon teaches that quantity and quality of cement, aggregates and mixing water, processes of mixing and curing are all involved in the production of concrete. Results are dependent upon all of these variable factors and it is the problem of the engineer to so control and vary these factors that a concrete having the desired physical qualities will result. To the onlooker the manufacture of concrete merely means the dumping of cement, aggregate and water into a mixer, thence transporting and dumping the wet mass into a mold which has been conveniently arranged in advance to receive it, but to the engineer the procedure is far more complex.

The manufacture of Portland cement itself is a large scale commercial operation carried on in large centralized plants under rigid and skillful control, and quality of the resulting product can be determined by certain standardized tests which are in general use. Likewise practical experience in actual construction work, together with laboratory investigations have resulted in a theory of design of reinforced members which is fully adequate and furnishes structures which favourably compare in cost and strength with the older types of structural materials. With a concrete of known quality the strength of the members composing a structure may be accurately computed and the values verified by actual tests when necessary. But, it is the problem of producing a concrete of definite and specified quality, with the many types of aggregates available, which has not been worked out to the satisfaction of engineers. The two other important elements, cement quality and design theory, have been well standardized, but the proper use of available aggregates to produce a definite quality of concrete is a constant source of worry to the engineer. To most engineers the discovery of some formula or equation in which he can substitute the variable factors as represented by his materials and job conditions and obtain by means of a slide rule such an answer as 1–2–4 or 1–3–6 would seem the ideal solution of the problem, and to this end numerous proportioning theories have been advanced, generally supported by more or less complete test data which appear to verify the correctness of the theory.

Before taking up several of these proposed proportioning theories in detail, it will be well to consider the present status of our knowledge of concrete and some of the factors which have influenced its formation. Years ago when concrete first came into general use it was common practice to use a very dry consistency, the concrete being so stiff that considerable tamping was required to bring moisture to the surface. Tests made in some localities showed such a concrete to have a compressive strength of about 2,000 pounds per square inch at twenty-eight days when proportioned, by volume, one cement, two fine and four coarse aggregates. Standard specifications for concrete as well as many individual specifications in the past have assumed 2,000 pounds as ultimate strength in structural design and called for a 1–2–4 volume concrete to be furnished. Lack of tests of field concrete has caused the continued use of these false assumptions, since it is now recognized that the cements and aggregates available in many localities cannot give a strength in excess of 800 to 1,500 pounds per square inch in such a proportion where workable consistencies are employed. Proper methods of inspection and test have shown that such a specification is inadequate to result in concrete of desired quality and the most discussed section of the proposed Joint Committee Specifications for Concrete and Reinforced Concrete, now being prepared in the United States, is that one which relates to the quality of concrete and a method of obtaining it.

While it has been known for years that quantity of mixing water has a very great influence upon concrete strength, regulation and measurement of consistency has generally been ignored in past specifications. Tests have shown that the use of excess mixing water, beyond that needed to result in a concrete which it is practicable to place, may reduce the strength to less than 50 per cent of that which might be obtained with the same cement content. That such a condition could have existed for so long a time is no doubt due to the fact that no satisfactory means were available for measuring and describing consistency. Within recent years two types* of apparatus have come into use, (a) the slump test, and (b) the flow table.

*For a description of both types see Canadian Engineer June 10, 1920.

The Slump Test

The slump test method was first used extensively in the field for controlling consistency of concrete in the construction of concrete ships by the Emergency Fleet Corporation. As first used it consisted of a cylindrical steel form such as is used for molding 6-inch by 12-inch cylindrical test specimens. This mold is filled in the usual manner and withdrawn vertically and the resulting height, in inches, of the concrete mass substracted from twelve, is known as the "slump". This apparatus is not sufficiently reliable or accurate to be adopted as a standard measure of consistency, since concretes having the same slump but varying in cement content or aggregate gradation may have widely different consistencies or flowabilities. On any job where the aggregate from day to day differs little in gradation, the slump apparatus will be found very useful in establishing a definite limiting value for consistency which must not be exceeded. However, in all cases a placeable concrete must be employed and the slump figure established must be based upon the conditions of the particular job. The slump value cannot be arbitrarilly established in advance except by previous experience with the same aggregates and cement quantities. The slump test apparatus can be made of much assistance in field work where its limitations are recognized, but any attempt to establish definite slump values in advance to apply to concretes on all classes of work and with widely varying aggregate gradations, is absurd.

The Flow Table

To supply the need for a consistency measuring apparatus which would be suitable and accurate enough for both field and laboratory practice the flow table was devised and standardized in the concrete laboratory of the Bureau of Standards. This consists of a metal covered table top mounted by means of a flanged coupling to the end of a short vertical shaft which carries at its lower end an adjustable bolt. Below the bolt is a cam having a throw of one and one-half inch attached to a horizontal shaft which is rotated by hand. One revolution raises the table top vertically and allows it to drop freely through a distance of one-half inch. Mortar or concrete is molded in a sheet metal form having the shape of a hollow frustrum of a cone, the form is removed and the table top raised and dropped fifteen times. The concrete mass flattens and flows out concentrically similar to a mass of concrete in pouring a floor slab when the wood form is vibrated. The spread, in inches, of the concrete on the table under the repeated bumping action divided by the original diameter and multiplied by one hundred is called the "flowability" figure. Tests show that flowability of any given cement-aggregate combination is directly proportional to change in quantity of mixing water, within the widest working limits of consistency, and that it is also proportional to velocity of flow in a steel chute. Continuous use of the flow table during the past three years, both in the laboratory and in the field has fully demonstrated its ability to accurately measure the consistency of concretes varying most widely in cement content and aggregate gradations.

Measurement of consistency has been dealt with in detail in the preceding paragraphs owing to the necessity for having a definite measure for this property of concrete, since compressive strength is in turn so greatly influenced by the water content. In studying proportioning theories and measuring the concrete making qualities of widely different types and gradings of aggregates, it is of fundamental importance that the consistencies of these concretes be equal. In the field the conditions of the work, such as size and shape of forms and quantity and arrangement of reinforcing steel, automatically establish a limit of dryness which cannot be exceeded, but in the laboratory, where a great amount of energy may be expended in molding a small test piece, the limitation as to dryness is not so apparent, and some mixtures, owing to difference of aggregate gradings, may actually be much stiffer thar others. Superior strengths obtained for some under suct conditions are not due to better concrete making qualitie of the aggregate but to the use of a smaller quantity o mixing water and one which would prove to be inadequat under field conditions. The use of the flow table wil result in the elimination of the consistency variable A second fundamental consideration in making com parative tests is the necessity for equal cement content per unit volume. Although dry proportions of material in all batches may be the same, the cement content i the wet concretes may differ owing to the greater bulkin effect or swelling of the mass when water is added. Sinc cement is the most expensive ingredient and also the onl strength furnishing component, it is essential that it quantity be the same in all concretes being compared.

Since most of the proportioning theories which hav been advanced deal with the selection of the aggregat it is a basic requirement that the variable factors, cemen content and consistency, be eliminated and made constant in comparative tests. As described above, equal cor sistencies can be assured by use of the flow table an equal cement contents can be provided by calculatin quantities of cement actually present in trial batches an by making proper adjustment of proportions whe necessary.

With the preceding considerations in mind a numb of the methods and theories proposed in the past f proportioning concrete will be discussed briefly. I general the methods proposed during the early years the development of concreting practice were concerne with the best combinations of aggregate particles, wit no attempt to predict strengths or satisfy specificatic requirements for strength. The water-cement ratio theo and the surface area theory of more recent years ha attempted to furnish a means of producing concrete any desired quality with wide variations in aggrega gradings, so long as the strength which will result fro any single grading is known.

Arbitrary Volume Proportions

This process is a method of proportioning rather th a theory. There are no considerations either practical scientific which justify the use of arbitrary volume prop tions. As stated previously, the almost universal assum tion that the proportions by volume of a 1 cement, pl 2 fine aggregate, plus 4 coarse aggregate will provide concrete having a compressive strength of 2,000 poun at 28 days is an example. This method fails to take in account the varying concrete making properties of differe

aggregates as well as variation in cement quality and its general use, in specifications for concrete, well illustrates the lack of knowledge of the various factors involved in the process of concrete making as well as failure to test concrete as placed on the job to insure that the specification requirement is being met.

Void Method of Proportioning

Several variations of the void method of proportioning have been proposed. In each case the idea has been to produce a concrete in which the void space will be a minimum. The assumption that the voids in coarse aggregate can be filled with sand particles and those of the sand with cement is, of course, erroneous since the smaller particles while partially filling void space also wedge apart the coarser particles. The best of concrete usually contains over 20 per cent void space, the higher the cement content the greater the void space and concretes having practically the same void space may differ several hundred per cent in compressive strength. In any case, after obtaining such an aggregate combination that the smallest possible void content will result, the strengths which will be attained by different cement contents must be determined by actual tests of the concretes. There is no feature in this method which permits the prediction of strength values and it is of little practical importance to the engineer.

Fuller's Theory of Maximum Density

In this theory* the assumption is made that with fixed cement content, an aggregate combined with cement, so graded as to have maximum density, will have maximum strength. It is claimed that with the same cement content strength will increase with increase in density. Such density increase can be obtained by regrading the aggregate. Sand and gravel or stone are separated into a number of sizes and re-combined so as to have a grading which will coincide with the "ideal" grading curve, or curve of maximum density, which was stated to be a combination of an ellipse and a straight line.

However, tests† of aggregates from numerous sources show that an aggregate can be screened and re-combined to have widely different gradings and yet produce concretes of approximately the same quality. Also with fine aggregates of the same grading, the relative proportions of fine and coarse aggregates may be so varied as to range over a broad zone when plotted graphically, and also produce concretes of different densities, but of approximately the same compressive strength. With the same cement content and aggregates from the same source of supply, the concretes of high density will usually have a relatively high compressive strength, but by changing the aggregate grading or by modifying the relative proportions of fine and coarse aggregate of the same grading a considerable decrease in density may result without lowering compressive strength. An aggregate so graded as to coincide with the "ideal" curve will often be lacking in fine particles, producing a harsh working concrete which segregates badly in the higher flowabilities.

The maximum density theory of proportioning is one application of the void theory. With equal cement contents the trend of increased strength with increased density is generally apparent, but in any case there may be so great a variation in density without lowering strength that it is difficult to see how the density factor can be made a criterion.

*Concrete Plain and Reinforced by Taylor & Thompson.
†Technologic Paper 58, Bureau of Standards.

Surface Area Theory of Proportioning Concrete

The surface area theory* of proportioning concrete assumes that strength is dependent upon the ratio of the weight of cement to surface area of the aggregate; that for a group of aggregates having different gradings and consequently different areas, and with cement content proportional to surface area, equal strengths will be obtained. A water formula was proposed which it was claimed would result in equal consistencies for such a group of mortars and concretes. However, tests† have shown that:

(a) This water formula furnishes such a quantity of water in each case that equal water-cement ratios will result; that is, the cement pastes alone will have equal consistencies with no allowance for the varying requirements of the sands which may differ greatly in surface area or fineness.

(b) The important property of surface area does not enter into the determination of the quantity of mixing water, except insofar as it fixes the quantity of cement at the beginning.

(c) The formula is not only incorrect in theory, but inadequate in practice and furnishes mortars and concretes varying widely in consistency, which are therefore in no sense comparable on the basis of strength.

(d) A normal sand may be regraded and so increased in fineness as to double the surface area and yet produce a concrete, with the same cement content and flowability, equal in strength to the mixture containing the normally graded sand having one-half the surface area.

(e) Not only the grading of a sand, but the relative quantity of sand in the mix may vary within wide limits without lowering compressive strength.

(f) It is quite evident that the author of this theory had no means of measuring and controlling consistency, since reproduction of the mortars and concretes used in his work varied widely in this respect and showed equally wide variations in compressive strength, although it was stated that the water formula would insure equal consistencies and equal strengths would be attained.

Water-Cement Ratio Theory of Proportioning Concrete

This theory†† has been developed and given prominence by the Lewis Institute Laboratory of the Portland Cement Association and has furnished the basis of a number of papers given to the various Branches of *The Institute*. This theory assumes that strength of concrete is dependent upon the ratio of the volume of mixing water to the volume of cement in the mix so long as the concrete is plastic and workable. It is further claimed that aggregates having the same fineness modulus will require the same quantity of mixing water to result in the same consistency or flowability when cement contents are equal. Quantity of mixing water which it is stated will result in any desired consistency may be computed from a water formula which involves the factors of cement content, fineness modulus and absorption of aggregate, and a constant water-cement ratio will result for all aggregates having the same fineness modulus.

This water formula, however, is based upon the same erroneous assumption as is the one proposed for the surface area theory of proportioning. It provides sufficient water to bring the neat cement pastes in the mixture to the same consistency, but does not make allowance for the varying water requirements of the aggregates which

*Canadian Engineer, Juy 4 and 11, 1918; November 27, 1919.
†Engineering News-Record, June 12, 1919; August 14, 1919. Canadian Engineer, January 15, 1920.
††Bulletin No. 1, Lewis Institute, Chicago.

for the same fineness modulus may vary as much as 600 per cent in surface area or fineness. The resulting concretes are not comparable owing to the wide variations in consistency. To add more water to the drier consistencies, so that they may be made comparable, results in the loss of the constant w/c relation, which is the foundation upon which the theory has been built, and which is the assumed criterion for equal strengths. Tests* show that, (1) the proposed water formula does not result in comparable concretes having the same consistency, and (2) even though the fundamental requirement that concretes must have the same consistency be waived, concretes prepared in this manner with a constant w/c may vary widely in compressive strength.

A full description of the water-cement ratio theory of proportioning concrete is contained in Lewis Institute Bulletin No. 1, issued in 1919, entitled, "Design of Concrete Mixtures". Test data which is intended to prove the correctness of the theory is given in table 2, in which are shown twenty-seven different aggregate gradings, having the same fineness modulus 6.04, and each of which when combined in a 1–5 volume concrete is claimed to have the same consistency when equal quantities of mixing water are employed. Figures are also given which show that the surface area of aggregate per pound of cement varied from 390 to 1,992, or more than 500 per cent, which indicates the wide variation in gradings which may be had with the same fineness modulus.

Tests* in other laboratories have demonstrated that the above claims are not true. These gradings were carefully duplicated and it was found that wide differences in consistency resulted both as measured by the slump test and also by the flow table. Some concretes were so stiff that the slump was zero, and the wet unsupported mass could be picked up in the hands and carried back to the mixer without losing its shape, while other mixtures were almost soupy in consistency. Even though such wide consistency differences do not permit of fair strength comparisons, compression test pieces were molded from each and the strengths at twenty-eight days were found to vary more than 30 per cent. The addition of more water to the dry or less water to the wetter mixtures, to result in the same consistency, of course destroys the constant water-cement ratio which is the basis of the theory of proportioning. Such results as were found, when these gradings were duplicated, clearly show that not even the slump test, inaccurate as it is, was employed to determine the consistency of the different mixtures which are included to prove the correctness of the theory.

The wide publicity which has been given to this theory has been of some benefit in that it has emphasized the injurious effect of excess mixing water beyond that amount required to produce a mixture having the minimum flowability required for the work at hand. However, contrary to the impression held by some, this effect of excess water is not an essential element in the proportioning theory advanced nor was this injurious effect discovered in working out this theory. That excess of water will reduce compressive strength has long been known to engineers who have been familiar with laboratory investigations of concrete and warnings that mixing water should always be held to a minimum have been given in earlier publications.†

*Engineering News-Record, June 12, and August 14, 1919. Proceedings A.S.T.M., Vol. XIX, pages 485 and 502.

†Technologic Paper 58, Bureau of Standards.

If the water-cement ratio theory of proportioning were correct we would be unable to use sands such as beach sands, or use "oversanded mixtures" without considerably reducing compressive strength. Yet tests show that fine sands, as well as excess of sand, in the mix, within rather wide limits, do not lower strength, and on the other hand furnish concretes having superior working qualities due to their small tendency to segregate in the wetter consistencies which must often be employed. Practice has also shown that even were the theory correct in principle it is impracticable to specify water-cement ratios which must be employed for different types and gradings of aggregates without previous experience with the same materials. As stated above, fineness modulus is not a criterion of the water requirement of an aggregate since this factor does not include surface area. However much or little water it is hoped can be added to a batch of concrete, the actual amount which must be used is established by the conditions on the work such as shape of forms, reinforcing steel, cement content, aggregate quantity and grading including its surface area, and not by cement content and fineness modulus alone.

Both the surface area and water-cement ratio theories of proportioning are fully discredited by a consideration of the very test data which the authors have advanced to support their respective theories, since sound principles of testing were violated in obtaining their test results. Had proper testing methods been employed in both laboratories and had proper appreciation of the fundamentals, which cannot be disregarded in testing work, been existent, there seems to be little doubt that these theories would never have been presented to the public.

While the discussion of both theories has done much to focus the attention of engineers on the feature of concrete proportioning, which is worthy of far more attention than has been accorded it in the past, both have failed to furnish the engineer with that much desired formula or equation which will permit specifying in advance quantities of materials to result in concrete of definite quality. After consideration of what has been brought out along such lines during the past few years it seems quite safe to say that such a short cut, for universal application, will not be found, but that the desired standard of concrete quality can be obtained and maintained only by co-operation between the testing laboratory and the field engineer, coupled with observation and experience. A little work properly planned will permit the determination of the approximate concrete making qualities of aggregates from our main sources of supply and a proper system of inspection and testing on all work of importance will permit of such modifications as are needed from time to time to correct for variations in cement and aggregate quality as well as other factors beyond control, which tend to effect the strength of concrete. For aggregates and cements in use in any locality from year to year there is no reason why fairly accurate combinations cannot be tabulated to produce concrete of any desired quality under known conditions. Experience and field tests will soon indicate the importance of the other variable factors which tend to influence quality and point out changes in proportions which must be made at times. Concrete, owing to its method of production will never be as uniform in quality as some other types of materials but there are no reasons apparent why many of the uncertainties now involved cannot be completely eliminated.

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THE

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Professional Meeting 1922

Winnipeg: September fifth, sixth and seventh.

General Professional Meeting Programme.

Those who have enjoyed the hospitality of the Winnipeg Branch are fully aware that they are masters of the art of entertaining their guests in a manner that does them credit. A glance through the programme of the general professional meeting of *The Institute* to be held at Winnipeg, September fifth, sixth and seventh, with headquarters at the Fort Garry hotel, will show complete arrangements for a gathering well balanced between professional sessions and social functions. Every engineer in Canada is interested in the great work being done in the neighbourhood of Winnipeg in hydro-electric development, and those who attend will have ample opportunity of inspecting these works as well as listening to papers descriptive of their details. Wednesday is given up entirely to excursions, visits to the plants of the Manitoba Power Company and the Winnipeg Hydro System, the visitors being guests of the Manitoba Power Company at luncheon and the Winnipeg Hydro System for dinner. Thursday's sessions include a civil section and a geological section in the morning and a civil section and a mechanical section in the afternoon. As shown by the titles and the names of the authors an interesting technical programme is promised.

Programme of the General Professional Meeting of The Engineering Institute of Canada, Winnipeg, September 5th, 6th, and 7th, 1922.

Headquarters, Fort Garry Hotel.

TUESDAY, SEPT. 5th.

9.00 a.m.—Registration.
10.30 a.m.—Opening Addresses.
11.15 a.m.—Discussion on Institute Affairs.
12.30 p.m.—Luncheon at the Fort Garry, provided by the Associatio of Professional Engineers of the Province of Manitoba
2.30 p.m.—Extensions to the Hydro-Electric System of the City o Winnipeg, by E. V. Caton, M.E.I.C.
3.30 p.m.—Manitoba Power Company's Development at Great Falls by F. H. Martin, M.E.I.C.
6.30 p.m.—A dinner given by the Winnipeg Branch at the Moto Country Club, Lower Fort Garry.

WEDNESDAY, SEPT. 6th.

Excursion to Great Falls and Point du Bois, visiting th power plant of the Manitoba Power Company, an that of the City of Winnipeg.
8.00 a.m.—Train leaves the C.P.R. station, arriving at Great Fall at 11.00 a.m.
11.15 a.m.—Luncheon will be served by the Manitoba Power Company
12.00 noon—Inspection of the work and plant.
2.00 p.m.—Leave Great Falls, arriving at Point du Bois at 4.30 p.m
4.30 p.m.—Inspection of the power plant.
6.30 p.m.—Dinner will be served by the Winnipeg Hydro System.
7.45 p.m.—Leave Point du Bois, arriving in Winnipeg at 11.00 p.m.

THURSDAY, SEPT. 7th.

Civil Section

9.30 a.m.—Improvements to Moncton Yard and Engine Facilitie by S. B. Wass, A.M.E.I.C.
10.45 a.m.—Automatic Box Car Unloaders for Grain, by Fred. Newel A.M.E.I.C.

Geological Section

9.30 a.m.—Fuel Values of Alberta Coals, by G. R. Pratt, A.M.E.I.
10.45 a.m.—The Geology of the Mackenzie Basin, by S. E. Slippe
1.00 p.m.—Luncheon at the Assiniboine Park under the auspices the City of Winnipeg.

Civil Section

3.00 p.m.—Considerations of a Road Policy, by M. A. Lyons. A.M.E.I.C.

4.15 p.m.—The Chemistry of Portland Cement and its Disintegration by Alkaline Ground Waters, by Prof. T. Thorvaldson.

Mechanical Section

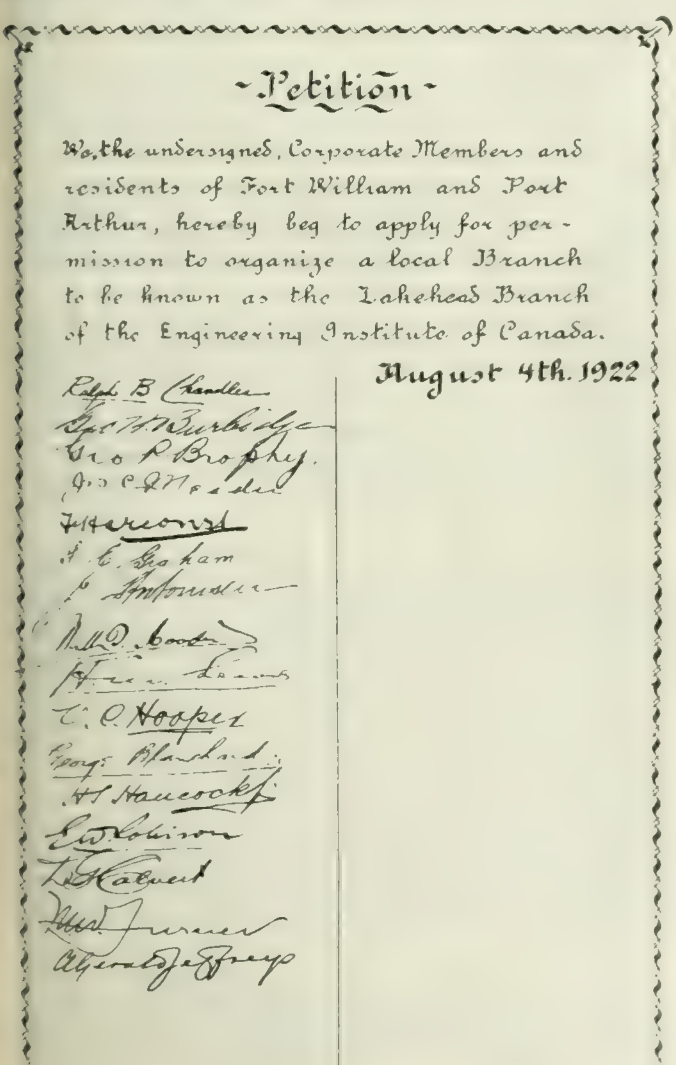
3.00 p.m.—Turbines for the Great Falls Development of the Manitoba Power Company, by H. S. Van Patter, A.M.E.I.C.

8.30 p.m.—Banquet at the Fort Garry Hotel.

The Lakehead Branch

The most recent engineering centre to anticipate organizing is Fort William and Port Arthur, a petition having been received through George H. Burbidge, M.E.I.C. at the last meeting of Council, to form a Branch to be known as the Lakehead Branch of *The Engineering Institute of Canada*. This petition was unanimously approved,and the organization meeting will be held immediately after the general professional meeting at Winnipeg.

As the form in which the petition was received showed unique preparation, and inasmuch as it will be of historic interest, it is reproduced herewith, the names of the signatories being easily recognized.



~Petition~

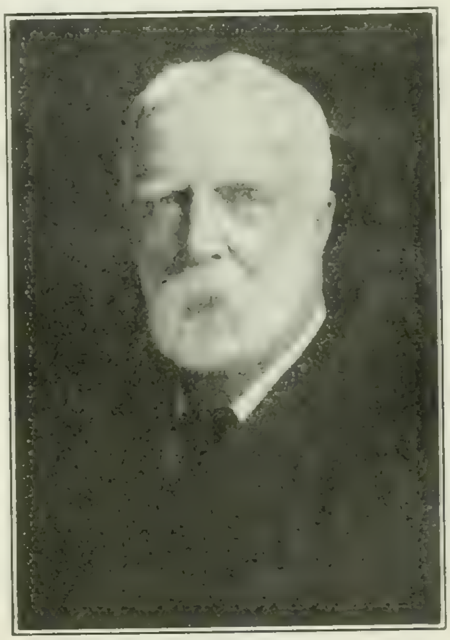
We, the undersigned, Corporate Members and residents of Fort William and Port Arthur, hereby beg to apply for permission to organize a local Branch to be known as the Lakehead Branch of the Engineering Institute of Canada.

August 4th. 1922

Ralph B Chandler
Geo H Burbidge
Geo P Brophy
C. O. Hooper
H Hancock

Unique Tribute to H. J. Cambie, M.E.I.C.

H. J. Cambie, M.E.I.C., for five years, 1892, 1896, 1901, 1904 and 1910, councillor of *The Institute*, in the days of the Canadian Society of Civil Engineers, was honoured by his fellow members of the Vancouver Pioneers Association, when at a meeting in Vancouver on August 14th, 1922, the members of the Association crowded the Eagles Hall to do honour to that grand old pioneer whose guiding hand and far-seeing vision was so largely responsible for making the shores of Burrard Inlet the terminus of a mighty railway. The old friends and associates of Mr. Cambie, who had been unanimously chosen at a previous meeting to be the first recipient of the medal to be annually presented by the Hudson's Bay Company, were there in full force and many were the kind words said regarding his past work in building up the city of which all are now so proud.



H. J. CAMBIE, M.E.I.C.

Unanimous choice of Vancouver Pioneers for First Hudson's Bay Company's Medal.

The presentation was made by H. T. Lockyer, general manager of the Hudson's Bay Company, on behalf of the company and the association. The speaker said that he entirely agreed with the unanimous view of the members that no recipient could have been selected more worthy of the honour. The medal, although not so large that it would take an express wagon to take it home, nor half good enough for the recipient, carried with it the sincere honour, respect and kindliest wishes of the company and the association. Mr. Cambie, through a long life, had earned the gratitude not only of British Columbia, but of the Dominion as a whole.

Mrs. Lockyer, amid cheers and the singing of "He's a Jolly Good Fellow." gracefully pinned the gold medal, engraved with the crest of the association and a suitable inscription, upon Mr. Cambie.

In returning thanks for the honour, Mr. Cambie was visibly affected, as were many in the audience. His

protest that many were worthier than he was met with loud cries of "No, no!"

"I may never address you again," he continued, "and I wish to express to the many friends here, whom I have met in different parts of the province during my long career, the deep sense of gratitude I feel for their good wishes, and for the great compliment they have paid me."

Mr. Cambie gave a short synopsis of his connection with Vancouver, the site of which he had first visited in 1874, coming by coach from New Westminster through the bush. He had lived here for thirty-seven years and he felt that this crowning event in his life was a proof that a prophet might have honour even in his own country. He concluded by saying that he had never made a real speech in his life and begged to be excused from attempting the feat at 86 years of age.

Mayor Tisdall paid tribute to one who had been largely instrumental in forging one of the great links of the Empire. The surmounting of the canyons of the Fraser had made for those great engineers a monument which would endure for all time. Mr. Cambie's life work had left an example for the youth of the country.

Mr. George Gordon, among other kindly things, emphasized the fact that Mr. Cambie had never been known to say an unkind word about others, nor, so far as he knew, had any unkind words been ever said of him. He possessed the esteem, love and respect of everyone in the community. Had he ever offered himself for public office he would hardly have had a vote against him.

Mr. Cambie was elected a member of the Canadian Society of Civil Engineers in 1888. His work on railway location, construction, and maintenance, from the time he entered the office of W. Walter Shanly in 1852, until he retired from the position of chief engineer of the Esquimalt and Nanaimo Railway, is recorded in the June 1920, issue of *The Journal.*

PERSONALS

D. W. Houston, A.M.E.I.C., has been elected to the Executive of the Canadian Electrical Railway Society, as Saskatchewan representative.

W. S. Gould, B.Sc., S.E.I.C. McGill University '22 is at present with the Abitibi Power and Paper Company at Iroquois Falls, Ontario.

H. Chantler, B.A.Sc., S.E.I.C. University of Toronto '22, has taken a position with the Malt Products Company of Canada, Ltd., at Guelph, Ontario.

A. A. Turnbull, Jr.E.I.C., is now connected with the New Brunswick Telephone Company, St. John, N.B., in their plant department.

J. H. Bradley, A.M.E.I.C., has accepted a position with the Canadian Bridge Company, at Walkerville, Ontario.

E. D. McIntosh, A.M.E.I.C., is engaged on road construction with the Provincial Highways Board, Ontario, and is located in Kent County.

Thomas S. Scott, M.E.I.C., who for some years has been on the staff of Queen's University, has been appointed city engineer for the city of Niagara Falls, Ontario.

J. A. L. Waddell, D.Sc., LL.D., M.E.I.C., received the high distinction of being elected on June 30th last, a Member of the Royal Academy of Sciences and Arts of Barcelona, Spain, (Real Academái de Ciencias y Artes).

W. N. Ryerson, M.E.I.C., until recently general manager of the Great Northern Power Company, at Duluth, Minn., is now with Day and Simmerman, Inc., at 611 Chestnut Street, Philadelphia, Pa.

Geo. F. Binns, S.E.I.C., is now with Peter Lyall and Sons Construction Co., as engineer on the constructior of the Royal George School, Notre Dame de Grace Montreal, Que.

A. G. Tweedie, A.M.E.I.C., of Sault Ste. Marie, Ontaric is fulfilling a contract for the construction of a concret dam on the Black river near Waltham, Quebec for th Pembroke Electric Light Co., of Pembroke, Ontario.

E. L. Zealand, S.E.I.C., of Hamilton, Ont., is concret inspector and instrumentman on the Bruce Division o the Canadian Pacific Railway and is at present locatec at Erin, Ontario.

H. E. Meadd, S.E.I.C., has accepted a position witl the Fort Francis Pulp and Paper Company Ltd., at For Francis, Ontario, and is engaged on paper mill design fo the company.

Kennington H. S. Hague, A.M.E.I.C., of Montreal, ha recently joined the sales staff of the Banking Servic Corporation in Montreal. Mr. Hague is a graduate o McGill of the class of 1914.

J. A. Loy, Jr.E.I.C., formerly inspector with Depart ment of Public Highways of Ontario, is now engaged o location surveys for the James Bay extension of th T. & N.O. Ry.

J. A. Hamilton Henderson, Jr.E.I.C., who graduate this spring from Queen's University, is continuing hi work in British Columbia as assistant geodetic enginee with the Geodetic Survey of Canada.

M. W. Turner, A.M.E.I.C., has been appointed supe intendent of construction in charge of the constructio of a two-machine paper mill for the Fort William Pap Company, Ltd., at Fort William, Ontario. Mr. Turn was formerly assistant engineer of the above company.

A. A. Richardson, A.M.E.I.C., formerly of Pete borough, Ontario, is now situated in Three Rivers, Que on the engineering staff of the Thompson Starrett Compan in connection with the construction of the new pulp an paper mill for the St. Lawrence Paper Mills Ltd.

John R. Montague, A.M.E.I.C., formerly with D. (Loomis and Sons of Montreal, has accepted the position personal assistant to H. G. Acres, M.E.I.C., chief hydraul engineer of the Hydro-Electric Power Commission Ontario.

Noël F. Harrison, A.M.E.I.C., of the Manitoba Pow Company, Ltd., engineering department, Winnipeg, is present on an extended visit to Ireland. Being interest in the development of peat-gas-power, he will stuc conditions there.

Lt.-Col. A. C. Garner, D.S.O., M.E.I.C., was elected a Fellow of the Royal Geographical Association in June. Col. Garner has over thirty years of residence in Western Canada to his credit, and has always taken a keen and practical interest in the development of the Dominion.

W. E. Longworthy, A.M.E.I.C., who following his return from the war has been in the employ of the City Engineer's Department at Regina, is vacating his post on August 21st, and has accepted a position with the Imperial Oil Company, Ltd., at Regina.

W. W. Perrie, A.M.E.I.C., of Saskatoon who has been engineer in charge of Federal Aid Road Work, for the Provincial Government, has accepted a position in the City Engineer's Department, Regina.

M. D. Stewart, S.E.I.C., has been appointed as purchasing agent with the firm of Bremner, Norris and Company, Ltd., and is located in Montreal. Mr. Stewart graduated in civil engineering from the University of Toronto this year, having specialized in hydraulic work during his final year.

M. P. Whelen, S.E.I.C., of Toronto, is now with the Power Sales Department of the Toronto Hydro-Electric System. Mr. Whelen who graduated in engineering from McGill University in 1921 was awarded the degree of M.A.Sc., at the last convocation of the University of Toronto, for research work on electric heating.

Kenneth B. Seely, Jr.E.I.C., has been appointed to the engineering staff of the Canadian General Electric Company, Ltd., at Peterborough, Ontario. Following graduation from the University of New Brunswick in 1920, Mr. Seely became associated with this company by taking the students engineering course which it offers.

P. A. Landry, A.M.E.I.C., has been appointed to the staff of W. J. Westaway and Company, McGill Building, Montreal. Prior to enlisting he had been land surveying in British Columbia for a number of years having been admitted to practise as a B.C.L.S. in 1909. Mr. Landry is an arts graduate of the University of St. Joseph, N.B., of the class of 1899 and a science graduate of McGill University in 1903.

R. B. Young, A.M.E.I.C., was elected secretary of Committee C-1 on Cement of the American Society for Testing Materials at the recent annual meeting held at Atlantic City, N.J. Mr. Young has been with the Hydro-Electric Power Commission of Ontario since graduating in 1913 and is now senior assistant laboratory engineer at the Engineering Materials Laboratories of the Commission.

C. Ben Bate, A.M.E.I.C., formerly of the engineering staff on the construction of the additions to the Hawkesbury mill of the Riordon Company, Limited, and more recently engineer on the construction of roads in the vicinity of Hawkesbury, has accepted the position of assistant engineer with Kerry and Chace, Ltd., and will be located near Pushthrough, Newfoundland, in connection with power investigation in that district.

F. L. Wanklyn, M.E.I.C., of Montreal, has been appointed one of the fuel controllers for the province of Quebec. Mr. Wanklyn is general executive assistant of the Canadian Pacific Railway. He is one of the Institute's earliest members having been connected with it since January 20, 1887. He was elected councillor in 1909.

G. R. Pratt, A.M.E.I.C., has been appointed fuel engineer for the Government of the Province of Alberta. In 1911 Mr. Pratt accepted the position of mechanical and fuel engineer with the Canadian Pacific Railway for the Western Lines and has occupied that position up to the time he received his recent appointment. Mr. Pratt has been with the Canadian Pacific Railway Company since 1906, having joined the construction staff at the Winnipeg shops in that year.

Dr. John S. Bates, A.M.E.I.C., of Bathurst, N.B. was elected president of the Canadian Institute of Chemistry, at the convention held in Ottawa this summer. Dr. Bates received his degrees of B.A. and B.S., from Acadia University in 1904 and 1909 respectively, and Chem. E., and Ph. D., from Columbia University in 1909 and 1913. He was for some time superintendent of the Forests Products Laboratories of Canada, and later joined the staff of Price Bros. and Company Ltd., at Kenogami, from which he resigned to accept his present position with the Bathurst Lumber Company.

H. Aldous, Jr.E.I.C., has recently accepted a position on the engineering staff of the Jackson Lewis Company, Ltd., engineers and contractors, Toronto. Mr. Aldous graduated in 1915 from London College of Municipal and Sanitary Engineering and is an Associate Member Institution of Sanitary Engineers, a Member Royal Sanitary Institute, and a Fellow Royal Meteorological Society. Following four years on active service, Mr. Aldous spent two years on public works in Norwich, England, coming to this country in 1921 to join the staff of the Department of Public Highways of the province of Ontario.

E. V. Caton, M.E.I.C., until recently chief engineer of the city of Winnipeg Light and Power Department has recently accepted the position of chief engineer of the Winnipeg Electric Railway Company. Mr. Caton was born at Brighton, England and received his early education at the grammar and technical schools of Brighton. His first work in the Winnipeg district was in charge of the erection of the electrical plant for the city of Winnipeg in 1911 and 1912 and in June 1912 he was appointed to the position which he has held until recently. In this issue of *The Journal* appears a paper in which Mr. Caton has described the extensions to the hydro-electric plant over which he has had charge for the past ten years.

J. E. Porter, A.M.E.I.C., formerly secretary-treasurer of the Border Cities Branch, is now located at Ford, Ontario, and is associated with the Engineering Department of the Ford Motor Company in charge of the civil engineering branch of the proposed extensions. Before receiving his degree of B.A.Sc., from the University of Toronto in 1915, he was engaged on maintenance work with the Algoma Central Railway for two years and as instrumentman with the Public Works Department for one year. His connection with this department was continued after graduation until 1918 as assistant engineer of the district of Western Ontario, following which he was appointed field engineer with the Canadian Steel Corporation Ltd., at Ojibway, Ontario, which position he held until he received his present appointment.

C. A. MAGRATH, M.E.I.C.

Appointed Member of Fuel Committee of Canada

C. A. Magrath, M.E.I.C., who is widely known in connection with his many activities of national importance has been appointed by the Federal Government a member of the Fuel Committee of Canada to advise on all questions which might arise out of the present fuel-supply situation resulting from the prolonged strikes. In this capacity, Mr. Magrath's services will be of great value to the country since his thorough knowledge of this important subject, as demonstrated during his tenure of office as fuel controller, in the winters of 1917 and 1918 when the last crisis in the supply of fuel occurred, is of vital importance in guiding the policy to be adopted in the present instance. Among the more important posts held by Mr. Magrath within the past ten years is that of member of the International Joint Commission to which he was appointed in 1911 and of which he became chairman in

C. A. MAGRATH, M.E.I.C.

1915, succeeding the Hon. T. Chas. Casgrain. In 1878 he engaged in irrigation and other development work in Northern Alberta. He represented Lethbridge in the North-west Assembly for several years, finally becoming a member in the Haultain Cabinet and later in 1908 represented Medicine Hat constituency in the House of Commons. He was appointed chairman of a commission created by the Government of Ontario in July 1913, to report upon a scheme for the construction, improvement and maintenance of the public roads and highways of the province of Ontario; which report was dated March, 1914. Following his final report as fuel controller in March 1919, he became a member of the Honorary Advisory Council on Highway Construction in connection with the administration of the Canada Highways Act and financial assistance to the provinces thereunder. In November 1921, he was appointed by the Government of Alberta, chairman of the South Alberta Survey Board, which was to look into certain questions respecting the development of the southern part of the province, and which reported the same year. The diversity of Mr. Magrath's activities is illustrated by the fact that he has been a member of the Executive Council of the Victorian Order of Nurses for some years and at the last annual meeting was elected president, and also an active member of the Patriotic Fund Committee since its formation.

EMPLOYMENT BUREAU
AND
MEMBERS' EXCHANGE

To make this department more valuable it is proposed that in future advertisements of situations vacant should state salary, and give details of requirements.

Situations Wanted

Civil Engineer

Civil engineer, eleven years experience in railway surveying, location and maintenance, A.M.E.I.C., 29 years of age, desires position, available now. Apply Box 115-P.

Chemical Engineer

Recent graduate in chemical engineering, McGill, desires position which offers a chance of advancement. Past experience in machine shop work. Apply Box No 112-P.

Civil Engineer

Civil engineer, A.M.E.I.C., age 30 years, married, three years on active service with rank of Captain, desires to engage with contracting firm, firm of consulting engineers or municipality. Experienced in railroad construction surveying, concrete bridge construction, highway construction, water supply and sewerage systems, past four years and at present, city engineer small city of 10,000 population. Desiring a change of location, am open for engagement. References on request. Apply Box No 110-P.

Civil Engineer

Position desired on survey or construction work by civil engineer with ten years experience in draughting instrument work, automatic signalling, interlocking maintenance of way, construction, structural and hydro electric development. Apply Box No. 111-P.

Mechanical and Structural Engineer

Recent graduate, age 26, married, good on organization and detail, wants employment on live mechanical or structural work. Training includes experience and special study on power (steam, hydraulic, and electric and combustion engineering. Can report immediately detailed information as to education, experience, and references, on application to Box No. 113-P.

Structural Engineer

Graduate of McGill University, A.M.E.I.C. 191- desires position on structural engineering, preferably a

resident engineer for some industrial firm. Experience on municipal work, building foundations and assistant resident engineer for a large steel company in Canada. Salary expected $300. per month. Apply Box No. 114.-P.

Situations Vacant

Sales Engineer

First class sales engineer to handle a high grade specialty, having sales ability and engineering knowledge, and capable of sustained sales effort. Executive ability would be advantage, and would open up for rapid advancement. Location Toronto. Apply Box 217.

Sales Engineer

Engineering salesman to handle building materials in the Montreal district. Applicant must be able to speak French. Apply Box 218.

Chemist (for Investigational Work with Soils and Fertilizers), Experimental Farms Branch, Department of Agriculture Ottawa.

4398. A Chemist (for Investigation Work with Soils and Fertilizers), Experimental Farms Branch, Department of Agriculture, Ottawa, at an initial salary of $2,700 per annum, which will be increased upon recommendation for efficient service at the rate of $120 per annum until a maximum of $3,180 has been reached.

Duties:— To direct and control, under the guidance of the Dominion Chemist, investigational work with soils, fertilizers, soil amendments, and crop nutrition in general, including the working out of detailed plans of research and experiment, the supervision of the field work connected with these, and also the laboratory investigations and analyses required; to prepare reports and bulletins on the results obtained; to give addresses on questions relating generally to soils and fertilizers; to conduct the necessary correspondence and to perform other related work as required.

Qualifications:— Graduation in science from a university or agricultural college of recognized standing: at least three years of post-graduate experience in plot control and allied work; research ability; supervisory ability.

Examination:— A rating on education and experience will be given from the sworn statements submitted by applicants on their application forms. To those who qualify, an oral examination may be given, if necessary.

Senior Quantity Surveyor

4399. A Senior Quantity Surveyor, Chief Architect's Branch, Department of Public Works, Ottawa, at an initial salary of $1,680 per annum, which will be increased upon recommendation for efficient service at the rate of $120 per annum, until a maximum of $2,040 has been reached. This initial salary will be supplemented by whatever bonus may be provided by law.

Duties:— Under direction, to prepare bills of quantities of materials and estimates of costs from construction plans; to check estimates and bills of quantities submitted by architects outside the Chief Architect's office, and those contained in tenders for proposed construction; to deduce and keep a record of unit prices; to design forms and compile statements; in some cases to direct the work of others engaged in similar work; and to perform other related work as required.

Qualifications:— Education equivalent to high school graduation; either graduation in architecture from a school of applied science of recognized standing with two years of experience in an architect's office, or four years of experience in an architect's office; familiarity with costs of materials; ability to prepare and interpret architectural plans and to estimate quantities of materials; ability to direct the work of others. While a definite age limit has not been fixed for this competition, age may be a determining factor when making a selection.

Examination:— A rating on education and experience will be given from the sworn statements submitted by applicants on their application forms. To those who qualify, an oral examination may be given, if necessary.

Pulp and Paper Specialist

For the following position preference in appointment will be given to residents of the districts where the vacancy occurs.

4401. A Pulp and Paper Specialist, Forest Products Laboratories, Montreal, Que., Department of the Interior, at an initial salary of $3,120 per annum, which will be increased upon recommendation for efficient service at the rate of $120 per annum, until a maximum of $3,600 has been reached.

Duties:— Under direction of the Superintendent of Forest Products Laboratories to plan and supervise the work of the Pulp and Paper Division of the Laboratories; to conduct research work relating to the chemistry of wood as applied to the manufacture of pulp and paper; to conduct experimental work relating to the chemical processes for treating wood commercially; to conduct special investigations relating to wood; to prepare reports and perform other related work as required.

Qualifications:— Education equivalent to graduation in science from a university of recognized standing, preferably with specialization in chemistry or chemical engineering; at least four years' experience after graduation, in research work relating to pulp and paper or in the manufacture of pulp and paper; wide knowledge of the technology of pulp and paper and of their industrial utilization; some knowledge of office practice; executive ability.

Examinations:— A rating on education and experience will be given from the sworn statements submitted by ppalicants on their application forms. To those who qualify, an oral examination may be given, if necessary.

General Directions

According to law a special preference is given first, to candidates who are in receipt of a pension on account of disability received as a result of war service and who have not been successfully re-established and secondly, to candidates who have been on active service overseas and who are found to possess the minimum qualifications for the position. The age limit does not apply to such candidates.

Application forms properly filled in must be filed in the office of the Civil Service Commission not later than September 14th, except in the case of Competition No. 4401 for which the time limit will be October 3rd. Application forms may be obtained from the offices of the Employment Service of Canada, from the Postmasters at Prince Rupert, Vancouver, Victoria, Edmonton, Calgary, Regina, Winnipeg, Quebec, Charlottetown Halifax, Fredericton, and St. John, or from the Secretary of the Civil Service Commission.

By order of the Commission,

W. Foran,

Secretary.

Members' Exchange

Back Numbers of The Engineering Journal Wanted

Several requests have recently been received for various numbers of Volume No. 1, 1918 of *The Engineering Journal.* Enquiries for Volume 2, No. 3, (March 1919), and Volume 3, No. 12, (December 1920) have also been received. As these are now out of print, any extra copies of the above issues which the members may wish to forward to the Secretary will be appreciated.

BRANCH NEWS

Calgary Branch

J. A. Spreckley, A.M.E.I.C., Secretary.
Floyd K. Beach, A.M.E.I.C., Branch News-Editor.

His Excellency the Governor General of Canada, and party, during their visit to Calgary and the vicinity, early in July, were taken over the eastern section of the Canadian Pacific Railway irrigation system, by A. S. Dawson, M.E.I.C., chief engineer of the Department of Natural Resources, C.P.R. The party visited Bassano dam, Brooks aqueduct, and other important structures on the project, and much interest was shown in these works and in the agricultural development resulting therefrom.

Irrigation Convention

There was a record attendance of 375 delegates and visitors at the annual convention of the Western Canada Irrigation Association, held at Maple Creek and Brooks from July 26th to 29th. Although most of the visitors were farmers from the two localities there was a good representation of engineers. Those from the Calgary Branch included Messrs. A. S. Dawson, M.E.I.C., W. Pearce, M.E.I.C., R. S. Stockton, M.E.I.C., F. E. Emery, A.M.E.I.C., P. A. Fetterley, A.M.E.I.C., M. H. French, A.M.E.I.C., W. B. Hutcheson, A.M.E.I.C., V. Meek, A.M.E.I.C., G. H. Patrick, A.M.E.I.C., C. A. Pope, A.M.E.I.C., B. Russell, A.M.E.I.C., W. H. Snelson, A.M.E.I.C., J. A. Spreckley, A.M.E.I.C., G. H. Whyte, A.M.E.I.C., H. J. McLean, Jr.E.I.C., and C. Errington, Jr.E.I.C.

Good publicity was given the convention in the press and a number of the addresses were reproduced in full. The Alberta Association of Professional Engineers was officially represented by three delegates.

Owing to the absence in the field of a large portion of the membership no meetings of the Branch were held in July.

Cape Breton Branch

Kenneth G. Cameron, A.M.E.I.C., Secretary-Treasurer.

Summer Outing

The members of the Branch, temporarily setting aside their multitudinous cares and worries, paid a visit on Saturday, August 5th to Louisburg and Sangaree. Leaving Sydney about noon, by automobile, they arrived in Louisburg in time for lunch and, thanks to the twenty-four-mile drive, very much in need of it. Lunch was provided by the parents of the Boy Scouts, in aid of that body, and was excellent in itself and very much enjoyed. About thirty members sat down, together with Mayor Martell of Louisburg, Archdeacon T. Fraser Draper, and six members of the staff of the Marconi transatlantic wireless station, including Mr. J. W. Mullins, manager of that company's Cape Breton operations,

CAPE BRETON BRANCH

VISIT TO LOUISBURG & SANGAREE

– AUG 5TH 1922 –

MARSHALL:
A.W MACMASTER

COMMITTEE
K H MARSH, H LONGLEY, C C CURTIS,
D S MORRISON, S C MIFFLEN
[THE COMMITTEE WILL REFEREE ALL DISPUTES]

"............ LET ME PLAY THE FOOL
WITH MIRTH AND LAUGHTER LET OLD WRINKLES COME,
WHY SHOULD A MAN WHOSE BLOOD RUNS WARM WITHIN
SIT LIKE HIS GRANDSIRE – CUT IN ALABASTER?"

ORDERS FOR THE DAY

11 30 am D S Time	Assemble at the Institute Rooms - Bank of Commerce Bldg, Sydney – Cars to be parked on Esplanade – Marching orders and equipment will be issued, and all contraband goods confiscated
12 00 noon	PROMPT – leave Sydney – car owners will convey other members, – drivers are urgently requested to keep within sight, not to pass each other, and not to exceed 50 m.p.h. as the road is not asphalted all the way
12 15 pm Std Time	Arrive Louisburg, and proceed to Parish Hall
12 30 pm	Lunch in Parish Hall – Chairman – Mr K H MARSH. After lunch the chairman will introduce Mr A A MARTELL, Mayor of Louisburg, Archdeacon DRAPER, and guests from the Marconi Station.
2 00 pm	Visit to the Ruins of the Fortifications – under guidance of Archdeacon DRAPER
3 30 pm	Visit to Station of Canadian Marconi Wireless Telegraph Co, – tour of inspection and address on Wireless Telegraphy by Mr F A SMITH – Acting Resident Engineer
5 30 pm	Leave for SANGAREE
6 00 pm	Dinner at KAMP KILL KARE – SANGAREE – Chairman – Mr K H MARSH [Make a joyful noise but remember that discretion is the better part of valour]
7.30 pm	Leave for SYDNEY – arriving about 9.45 pm D S Time

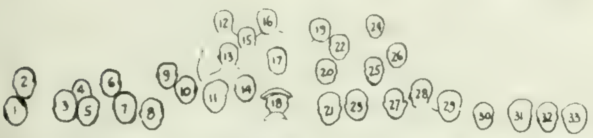
Only those members will be conveyed home, who can say – clearly, distinctly, and whole-heartedly –

"THE ENGINEERING INSTITUTE STEADILY STRIVES TO STIMULATE STRICTER STANDARDS"

Following lunch, the chairman, K. H. Marsh, M.E.I.C., introduced Mayor Martell, who extended a most hearty welcome to the company, both individually and as representative of the engineering profession, from whom, he said, one could always be sure of a warmer welcome and a heartier handshake than from any other people. The appearance of an engineer in any locality, he said, was always looked upon as the forerunner of development or activity of some description, and he felt that, although the company was on a pleasure, rather than a business expedition, still one might expect boundless possibilities from such an aggregation of engineering talent.

The chairman then introduced Archdeacon Draper, who had only that week celebrated the fortieth anniversary of his service in Louisburg. Mr. Draper endorsed the Mayor's welcome, mentioning particularly his friend and our chairman, C. M. Odell, M.E.I.C. He outlined the possibilities of development in Louisburg, — the oldest harbour

Cape Breton Branch visits Louisburg and Sangaree



1 W BOWN	8 J W MULLINS	15 J R MORRISON	22 R M McKINNON	29 J G H PURVES
2 W G WILSON	9 A BARLOW	16 J A FRASER	23 S C MIFFLEN	30 A W MACMASTER
3 A L HAY	10 H B GILLIS	17 D S MORRISON	24 E C TONGE	31 T J BROWN
4 M McDONALD	11 MAYOR MARTELL	18 C M ODELL	25 J W CARLIN	32 H LONGLEY
5 K G CAMERON	12 R BOWN	19 R J FISHER	26 H E COMO	33 D McDONALD
6 G DOHERTY	13 D BROWN	20 R J McNEIL	27 O A MACLEAN	
7 K H MARSH	14 G BEATON	21 ARCHDEACON DRAPER	28 N S WILSON	

on the east coast of America, spoke of the early activities when the town was founded, and briefly outlined the history of the military founding and occupation of the town, with which every Canadian should be familiar. Mr. Mullins and Mr. MacDonald of the wireless station, expressed their pleasure in being present, deferring further remarks until the members reached their company's headquarters. The chairman then called upon T. J. Brown, M.E.I.C., who speaking of the history of Louisburg and its direct influence on Canadian history as a whole, deplored the fact that so little interest has been taken by the governing bodies of the country in the preservation of the fortifications and the erection of an adequate permanent memorial to commemorate the events of 1745-58. It was to the lasting discredit of the Canadians, he said, that the only memorial erected was placed there through the initiative, and at the expense of the American people. He undertook to say that the Branch would endeavour to use its influence to have this manifest wrong righted.

The members then adjourned to the Old Town, where under the guidance of Archdeacon Draper, they viewed the remains of the old fortifications, erected at a cost of ten million dollars, and now a mere heap of grass covered stones. Unfortunately, fog and rain prevented the thorough inspection which members wished to make, but the visit has at least had the effect of awakening a wider interest among the party. It is but a short distance from the ruins to the transatlantic station of the Marconi Wireless Telegraph Company, at which place the members were received by the staff, and shown the inner workings of the invisible science.

Returning to the New Town, the party bade adieu to their guests, and proceeded to Kamp Kill Kare at Sangaree, stopping on the way to show their appreciation of their chairman, Mr. Odell, who had accompanied them so far, in spite of recent illness, but was now returning home. Sangaree is beautifully situated on the Mira river. After dinner, with the help of a piano, each did his extemporaneous best to surprise his neighbour, succeeding in varying measure, but on the whole, pleasantly.

Leaving at dark, the party returned through heavy rain, but though wet externally and, (comparatively), dry internally, the day was considered very successful, and it is hoped that it helped the individual member to realize that his professional associates, like the Colonel's Lady and Judy O'Grady, have a human side under their business armour.

Saskatchewan Branch

D. A. R. McCannel, A.M.E.I.C., Secretary-Treasurer.

The Papers and Library Committee are completing arrangements for the delivering of papers before the Saskatoon members, full particulars of which will be available shortly.

Members report improved conditions in engineering activities and with the prospects of a good crop, conditions at the moment look promising for next year.

Annual Summer Meeting

The Saskatchewan Branch held their annual summer meeting on July 15th, and the proceedings opened at noon with an inaugural luncheon at the C.P.R. dining hall. The business proceedings opened at 2 p.m. at the Public Library, and this was mostly of a technical nature.

H. S. Carpenter, M.E.I.C., Deputy Minister of Highways, gave an account of the proceedings of the convention of the Canadian Good Roads Association, and the professional meeting of *The Engineering Institute* both of which were held recently in British Columbia.

In the discussion that followed the reading of the papers, it was the general opinion that the good roads movement was one of the most important in the province. It was felt that the movement was about fifteen years late in starting and that this lost time must be made up, if possible.

The report of the committee on policy was read by the secretary.

Professor G. M. Williams, A.M.E.I.C., of the University of Saskatchewan read a paper on "Concrete," after which a long discussion on the subject ensued.

The evening took the form of a banquet at the C.P.R. dining hall and after the banquet had been served short addresses and musical items were given.

The chairman for the day was J. R. C. Macredie M.E.I.C., divisional engineer for the C.P.R.

The first speaker after the banquet was Colonel A. C. Garner, M.E.I.C., of Regina, who spoke of the Natural Resources of Saskatchewan.

Professor C. J. Mackenzie, M.E.I.C., of the University of Saskatchewan, spoke on "Engineering", while the other speakers included, A. E. Hamilton, James Pascoe, M.L.A., George Baker, M.L.A., and Commissioner George D. Mackie, M.E.I.C.

OTHER SOCIETIES NEWS

International Roads Congress.

A certain indication that after eight years of war and upheaval the world is beginning to return to a normal state is contained in the announcement that the International Road Congress, which ceased operations in 1914 because of the European conflict, is to resume its deliberations early next May at Seville, Spain. The program for what promises to be the greatest and most important conference on highway improvement ever held, has just been received from the office of the general secretary in Paris.

Thousands of delegates representing national and state governments and good roads associations throughout the world will participate in the congress and exchange views and experiences for mutual benefit. English, French and Spanish, have been adopted as the official languages. The first congress was held at Paris in 1908, the second at Brussels in 1910, and the third at London in 1913.

The Federated American Engineering Societies.

The weekly bulletin of The Federated American Engineering Societies has been discontinued with the issue of August 11th, 1922, and as been superseded by a monthly printed bulletin September 1, in accordance with instructions of the Executive Board issued at its meeting May 27, 1922. Arrangements are now in progress with secretaries of all local societies whereby the bulletin will be sent to their respective membership on the first Friday of each month. The bulletin will contain articles on activities of the F.A.E.S. and information of the character previously published will be given in more complete detail. A section will be devoted to the activities of member and prospective member organizations. It will also contain an editorial page. In short, the printed monthly bulletin is designed to serve the purposes fulfilled by the mimeographed weekly bulletin, but by printing it and issuing it monthly the circulation can be very much increased.

National Hydraulic Laboratories.

Hearings will begin the latter part of this month in the United States on the National Hydraulic Laboratory Bill in which the Federated American Engineering Societies is interested. This laboratory would make it possible to concentrate attention on the scientific side of flood control and other hydraulic problems. John R. Freeman and Mortimer E. Cooley have been invited to make the initial presentations of the matter before a sub-committee of the Senate Committee on Commerce, appointed for the purpose of considering that measure.

Water Power Regulations.

Following the definite action taken on the depreciation regulation, the United States Federal Power Commission is planning to take up for early consideration the regulation dealing with accounts and reports. A final conference with representatives of the National Electric Light Association and of the National Association of Railroad and Utilities Commissioners will be held the first week in September, when it is believed an accounting system can be worked out which will be adapted to the needs and wishes of licensees and of the state commissioners.

The Sixteenth Annual Convention of the Western Canada Irrigation Association

Many of the western Branches of *The Engineering Institute of Canada* were represented at the sixteenth annual convention of the Western Canada Irrigation Association which was held at Maple Creek, Saskatchewan, and Brooks, Alberta, July 26th to 29th. The investigation, construction and operation of irrigation works in western Canada is now proving a large and evergrowing field for engineering endeavour and its importance is becoming more and more emphasized every year. The need for the proper training in Canada of young men to take their place in this work was brought out in a resolution which requested the Universities of Saskatchewan, Alberta and British Columbia, to supplement their present engineering courses to whatever extent is necessary to offer adequate instruction in irrigation engineering.

The addresses at the convention covered many agricultural and engineering phases of irrigation. Frank W. Hanna, M.Sc., until lately consulting engineer to the United States Reclamation Service, and now general manager of the Canada Land and Irrigation Company, gave a practical address on the "Limits of Pumping Irrigation", which was followed by a useful discussion. Another address of special interest to the engineers present was one by W. C. Muldrow, manager of the Columbia Irrigation District in Washington, on "The Life and Efficiency of Canal Linings." It was apparent that Mr. Muldrow had made a special study of his subject for many years and his address and the discussion which followed was greatly appreciated.

The first day of the convention at Brooks was spent in driving over some of the surrounding country. The district is being rapidly developed and presents a striking contrast to its appearance of only five years ago, whi[le] what it looked like when the first construction engineers arrived at about fifteen years ago, may be surmised. Near Brooks are two of the most interesting irrigation structures in North America — the Bassano dam and the Brooks aqueduct. It was not possible to include a visit to the Bassano dam in the programme of the convention but the Brooks aqueduct, lake Newell and many other of the engineering features of the eastern section of the C.P.R. irrigation block were visited and inspected with a considerable show of interest by many of the delegates.

Among the members of the Edmonton Branch who were present at the convention were Professor R. S. Wilson, A.M.E.I.C., of the University of Alberta, and R. Gibb, M.E.I.C., assistant city engineer of Edmonton, while the Calgary Branch was represented by W. [ ] Hutcheson, A.M.E.I.C., and M. H. French, A.M.E.I.C.

Association of Professional Engineers of Ontario

Active organization has been commenced in connection with the Association of Professional Engineers of Ontario, and at a meeting of the Provisional Council held on August eighth and ninth a sub-committee was appointed to draft by-laws, which will be considered at a second meeting of the Provisional Council to be held on August twenty-eighth.

Trade Publications

The Rotary Ash Discharge. The American Engineering Company of Philadelphia, Pennsylvania, has prepared for distribution a small pamphlet describing the Rotary Ash Discharge installed in connection with the stoker equipment of large boiler plants. The booklet contains illustrations of a number of large power plants in which the Rotary Ash Discharge has been applied to the boilers in which Taylor stokers are installed.

CORRESPONDENCE

The Transmission of Energy by the Water Molecule

Its Relation to Basic Production

Toronto, July 27, 1922.

Editor, *Journal:*—

Dear Sir:

In the July issue of *The Journal,* it was shown how the radient energy from the sun is stored in the water molecule as potential surface energy, and also how nature contrives to render this energy available as heat. It is proposed to describe here some phenomena in connection with its distribution.

We may now understand the process by which nature not only irrigates the land surface of the earth, but transmits the radient energy of the sun through the envelope of air. The energy of the sun's rays, intercepted by all surfaces containing moisture and all water surfaces, is employed to create free surface areas about the molecules in which it is stored as potential surface energy. The way the molecules are separated from the liquid is similar to the way a water drop is broken away from a larger mass. When free they move away with their kinetic energy undiminished in longer free paths, notwithstanding that each now carries a load of potential energy nearly twelve times as great as its own kinetic energy. In the upper regions of the air after various encounters with dust particles, molecules of air, and each other, the water molecules go through the first stages of their condensation during which, as we see from the table previously given, large quantities of latent heat they carry as P.S.E. are released and become effective in raising the temperature of the air. Thus, if the condensation proceeds through the tenth stage and halts, the moisture in the air will consist of small spherical particles each containing 1,024 molecules and having a diameter ten times that of a molecule, but they will still be too minute to be seen with a microscope. The heat produced, however, will be as great as 90 per cent of the whole latent heat and will be sufficient to raise the temperature of the air by a sensible amount.

This distribution of the radient energy of the sun by the water molecules carrying it as P.S.E. and releasing it to warm the air by the simple process of coalescing may be further illustrated. A garden plot in the Niagara Peninsula thirty by forty feet, has a rain fall of about thirty inches. To set free the necessary number of molecules and load them with their P.S.E., the sun must supply power equivalent to that of an engine of 1,500 horse power, running continuously throughout the year. Not only is the water furnished to enable the plants to feed and grow but the heat that "keeps up the steam" is all employed to warm the air that the plants may breathe. To produce a British Columbia fir tree the same powerful engine must work continuously for 225 years.

This is nature's means of making effective her plan of storing the sun's energy in large amounts on the earth's surface in a more or less permanent form. It enables her to maintain the water elevations as a constant source of energy which we are now using in large amounts for the first time. It brings about the necessary conditions of moisture and temperature to enable the direct sunlight to produce by chemical action the various hydrocarbons upon which our life depends. Indeed only for this the extremes of temperature during the day and night would be so great as to render life of any kind impossible.

There is no doubt that the large quantities of heat yielded up by the water molecules in the air during the early stages of their coalescence, or condensation, is a considerable factor in causing storms of various types. A large column of warm air, hundreds of miles in diameter, is gradually formed over a certain tract of the sea or land. This air being lighter begins to be replaced by colder and heavier air masses from the outside thus causing surface winds towards a common center. The motion of the earth on its axis together with the inclination of the earth's surface to the axis would then divert this central direction of the winds into a wide circular sweep so frequently recorded in the weather charts of America. The warm central water-charged column of air would spread over the colder layer beneath and the invisible water spheres would coalesce into visible particles between these layers where they would be seen as clouds and on further coalescence would fall to the earth as rain. In all this process the remaining part of the latent heat or P.S.E. would be released to warm the colder stratum of air beneath, until a state of equalized temperature and saturation would be attained marked by clearing skies and falling winds. In some cases the concentration of these phenomena in small areas would result in violent cyclonic storms. In most cases, however, the great heat produced during the first stages of molecular condensation would result in the formation of stratified layers of air of different temperatures containing water particles of unequal sizes. These particles would condense as before between the strata and tend to form clouds, thus equalizing the temperatures of adjacent layers; while, according to the degree of saturation, either the visible particles would coalesce further into rain or the clouds would disappear altogether.

Again, in some unexplained way we know that the particles of water in a cloud or stratum of air become charged electrically, not improbably by the addition or removal of electrons which are held in, and by, this force-energy-surface enveloping the spheres and from which they cannot escape. If two such charged particles happen to coalesce, the electrons in them would instantaneously make a new adjustment on a contracted superficial area. This would cause the density of the charge, (the number of electrons per unit of area), to be altered, that is, the charge would be held at a different potential. Now the water particles which come from the same part of the earth's surface would carry like charges and, consequently, any coalescence that would take place would cause an increase in potential. The mutual repulsion between these similarly charged particles would no doubt delay the coalescence by hindering contact, or perhaps in some case prevent it altogether. This may be the cause of the particles of water remaining in a cloud or fog in a stationary state of condensation. Notwithstanding this, the condensation would be considerable and the charge on the particles of a cloud or invisible stratum would be raised to a high potential difference from the surrounding air. When such a cloud or stratum meets another having an opposite charge, there would be a passage of electricity from the one to the other. At the same time the water particles of the one would be attracted to those of the other and coalescence would be greatly augmented, attended by the release of heat and increased precipitation of water. This is given as an explanation of thunder storms.

Not only human life but life of all kinds, animal and vegetable, depends on the fact that energy which comes from the sun by radiation is held on the surface of the earth in some potential form for a longer or shorter time. The only way we know now of replenishing this store of potential energy is by the production of the various hydrocarbons of which our food, clothing, and in great part our shelter consists. Nature is doing this on a prodigious scale, but probably not at so great a rate as in the carboniferous age. The capture of the sun's radient energy and its distribution by the water molecules is an essential part of the process. Only for this the heat rays from the sun would pass through the air without raising its temperature. Without the water molecules to carry the heat away, the solid surface of the earth would become extremely hot during the day by the absorption of large quantities of heat and would cool off during the night, when all this heat would be radiated into space again. The practical application of the solution of these problems lies in a fuller knowledge of the laws by which nature is working so that we may enable her to increase her output. The possibilities in this direction are almost unlimited.

To sum up; the water molecule on escaping from its liquid assumes a load of potential energy on its surface exactly equivalent to the energy of its dissociation supplied by the sun's rays. It carries this energy through the air unchanged in amount, whether its own motion be slow or swift. Through the act of coalescence on contact with other molecules in the air, both this energy as heat and its mass as water are made available at various places on the earth's surface. These then, through the action of the direct rays of sunlight in the presence of living organism, are instrumental in producing the various hydrocarbons of which the stores of the earth's potential energy consist.

Sincerely yours,

WILSON TAYLOR, B.A., Associate E.I.C.

Preliminary Notice

of Applications for Admission and for Transfer

20th July, 1922

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in August, 1922.

Fraser S. Keith, Secretary.

*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option, Railway, Municipal Hydraulic, Mechanical, Mining or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years

Every candidate for election as JUNIOR shall be at least twenty-one years of age and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects, Geography, History (that of Canada in particular), Arithmetic, Geometry, Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits scientific acquirements ,or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge

The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members

FOR ADMISSION

CARSON—WILLIAM JAMES, of Grand'Mere, Que. Born at Danville, Que., Aug. 11th, 1894. Educ., A.A., Danville Academy, '10, and I.C.S.; 1910-11, rodman and chainman, and 1911-12, field engr's., asst. and mech. dfting., Laurentide Co., Ltd., Grand'Mere; 1912-15, field engr., on constrn. Laurentide Power Coy's. plant and dam, including topogr'l. survey of St. Maurice River; 1915-16, in chg. of party on Forest Surveys for Forestry Dept., same company; 1916, enlisted Canadian Forces; overseas, 1917-19, with Canadian Engrs.; Aug. 1917, loaned to Imperial Air Ministry for engr'g. work, acted as drainage engr. or clerk of works on aerodrome constrn., under Mr. D. Balfour, M.Inst. C.E., F.C.S., F.R.M.S.; 1919-22, engr. in chg., constrn., New Water Supply for City of Grand'Mere and engr., to Logging Divn., on surveys, design of dams, improving streams for driving purposes, etc., and to date, field engr., in chg. engr'g. work for Logging Divn., Laurentide Company Ltd., Grand'Mere; appointed City Engineer for City of Grand'Mere, May 1922 and at present design'g. a new sewerage project for the city.

References: H. J. Lamb, W. S. Lea, H. O. Keay, M. J. Leahy, J. J. O'Sullivan, H. E. Bates.

DUNLOP—HENRY JOSEPH, of Ottawa, Ont. Born at Groves Point, N.S., April 12th, 1892. Educ., B.Sc., Queen's University '13; 1908, (May-Nov.), rodman and chainman on Militia and Defence Dept. Surveys in Ontario; 1909 (summer), rear chainman on same surveys in Quebec and two months instr'man; 1910-11-12-13, (summers), in chg. of traverse party, running control lines for topography, for Militia and Defence Dept. two seasons in Nova Scotia, one each in Quebec and Ontario; 1914-17, Special Surveys Engineer's office, Topographical Surveys Branch, Ottawa, examining Surveyors' returns; 1917-19, Lieut. overseas on location, constrn., and mtce. of narrow and standard gauge rlys., 10th Batt. Can. Rly. Troops; 1919 to date, asst. magnetician, Topographical Surveys Branch, Dept. of Interior, Ottawa.

References: F. L. C. Bond, A. Macphail, W. L. Malcolm, G. B. Dodge, E. M. Dennis, T. S. Mills.

FARNSWORTH—FREDERICK DeWITT, of Annapolis Royal, N.S. Born at Hampton, May 31st, 1885; Educ., Victoria School of Art and Design, Halifax, I.C.S. (civil engr'g.); 1911-12, C.P.Rly., western lines; 1912-13, Dominion Bridge Co.; 1913-14, asst. engr., design'g. and constr'g., sewer systems, water systems and pavements, H. N. Ruttan, Winnipeg; 1914-15, Prov. Govt. of Manitoba; 1915-18, on engineering staff of Can. Overseas Rly. Coast Corps, laying out rlys., gun spurs, ammunition yds. and bldgs. in France; 1919-20, in chg. 1400 miles of Highways with culverts and bridges (constrn. and mtce.), Prov. Highways Board, Nova Scotia; 1920 to date, ch. engr., Reid, Farnsworth & Shafner, Ltd., Engrs and Contractors, Annapolis Royal, N.S.

References: H. N. Ruttan, L. W. Lester, J. W. Roland, J. E. Belliveau, E. M. Archibald.

FRASER—WILLIAM LAWRENCE, of Sable River, W., N.S. Born at Thorburn, N.S., May 15th, 1894; Educ., B.Sc., (Civil) McGill Univ., '17, B.A., Dalhousie Univ., '15; 1915 (summer) municipal work, E. S. Fraser, Town Engr., New Glasgow, N.S.; 1916 (summer), dftsman., C. D. Howe, consltg. engr., Regina, Sask.; 1917-18, dftsman on design reinforced concrete terminal elevators, C. D. Howe & Co., Port Arthur, Ont.; 1919-20, traffic dept., Bell Telephone Co., Ltd., Montreal; 1920 (May-Sept.), constrn. dept., Abitibi Power and Paper Co., Iroquois Falls, Ont.; 1920-21, dftsman and estimator, D. G. Loomis & Sons, Montreal; 1921 to date. Engineers and Contractors, Annapolis, N.S., as follows — 1921, supt. in chg. constrn., Middleton, Aylesford Highway and 1922 to date, in chg. constrn., Sable River, Lockport Highway.

References: E. S. Fraser, E. M. Archibald, H. M. Mackay, G. R. Heckle, J. R. Montague.

GARDNER—ALBERT CHARLES, of Medicine Hat, Alta. Born at Haddington, Scotland, Sept. 23rd., 1887. Educ., 4 yrs. Heriot Watt Tech. Coll; premium indentured pupil, L. B. Barclay, C.E., F.R.S.E., Edingurgh, 1906-09, running level, transit, box sextant, preparing plans and instructn. in setting out work etc., and office work; 1908, asst. engr., designing sewers, specifications, stream gaugings, rainfall records and design'g. stone and brick houses; asst. supr'vising engr., on constrn. McDonald Rd. condensing scheme; 1909, promoted ch. asst. engr ; res. engr.; Juniper Green and Colinton Drainage contracts (tunnel and open cut); acted as contractor's engr., Redford Barracks Drainage (British War Office Dept.); contractor's engr., Troon Water Works, Ayr, Scotland, concrete dam 1500 ft. long, syphon wells, screening chamber, gauge house, granite valve tower, O. G. tunnel etc.; 1917 to date, tracing, design'g. structures, in chg. classification and location parties, hydrometric work, steam shovel, cross section work etc., Canada Land and Irrigation Company.

References: D. W. Hays, V. Meek, F. K. Beach, H. G. Dimsdale, W. S. Miller.

GESSAMAN—WALTER F., of Windsor, Ont. Born at Columbus, Ohio, Sept. 23rd., 1887. Educ., High School and passed entrance exam. to Case School of Applied Science; 1906-07, concrete foreman on street pavements and reinforced arches *1908-14, responsible to gen. supt., for mechanical constrn. of all incandesent lamps, Banner Electric Works, General Electric Co.; 1915-16, rodman and instr'man. on blast furnace and rolling mill constrn., and 1916-(July-Aug.), chief of field party on blast furnace constrn., Republic Iron and Steel Co.; 1916 to date, field engineer on property surveys town site layout, storm drains, factory bldgs., and blast furnace constrn., Canadian Steel Corporation, Windsor, Ont.
*Vetter Construction Co.

References: W. H. Baltzell, E. J. McIntire, J. E. Porter, J. S. Nelles, H. Thorne.

GREEN—LEONARD, of Calgary, Alta. Born at Peterborough, England, August 31st, 1878. Educ., Norwich Higher Grade School, graduating in Science and Art; 1893-1900, apptce'ship., mech. engr., Great Eastern Railway Locomotive Works, Norwich; 1901-11, marine engr., steamships, carrying 1st class engr's. cert., granted by Marine Dept. of British Board of Trade; 1913-15, ch. engr., Saskatoon Brewing Co.; hold 1st class engr's. cert. for Prov. of Sask.; 1915-17, res. boiler inspector, Boiler Inspection Insurance Co. of Canada, Toronto; 1917-21, sales engr., mining machinery, irrig. and municipal pumping plants, Gormons Ltd., Calgary, Alta.; at present, sales engr., Power Plant and Steam Speciality Dept., Crane Limited, Calgary, Alta.

References: F. E. Emery, W. B. Trotter, H. J. McEwen, G. W. Craig, A. L. Ford, P. J. Jennings, F. K. Beach.

HAVENS—VERNE LEROY, of New York, U.S.A. Born at Atlantic, Iowa, June 17th, 1881. Educ., Special student, Univ. of Nebraska and pvte. tuition; 1898-1900, chainman, rodman and topogr., on railway location and survey work; 1901, res. university work; 1902, asst. engr., reconstrn., 50 mile line, Union Pacific Railroad; 1903, divn. engr., heavy mountain constrn., Mexican Central Railroad; 1904, asst. engr. streets and blvds., Omaha, Neb.; 1905, asst. ch. engr., Tri-State Land Company, Neb.; 1906, asst. engr., Mexican Light and Power Co., Nexaca, Pueblo, Mexico; 1907, electrified and reconstr'd., street railway, San Francisco, Cal.; 1908-11, ch. engr., designed and built by administration 6 power houses, elect. street lines, canals, pumping stations, steam rlys. reservoirs etc., Mexico Light and Power Co., Tramways Co., and Steel and Chemical Co., and Pachucha Irrig. and Power Co.; 1913-14, consltn. work., reports for financing rlys. in So. America; 1915-17, commer. attache to American Embassy, Santiago, Chile and reports on economic conditions in Bolivia, Uruguay and Argentina; completed and published "Ingenieria de Ferrocarriles" Rly. Engr'g; 1917-19, consltn. work, tech. and commer. problems for public utility corprns., in Brazil, Mexico and Spain; 1919 to date, Editor and Director, Ingenieria Internacional, tech. magazine in Spanish on civil, electrl. mech. and mining engr'g., McGraw-Hill Co., 10th Ave., New York City.

References: J. A. L. Waddell, A. Hazen, H. Goldmark, R. S. Buck, W. W. Colpitts, J. V. Davies, C. E. Fowler, T. K. Thomson.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

ANDERSON—FREDERICK WILLIAM, of New Westminster, B.C. Born at Ottawa, Ont., Sept. 28th, 1883. Educ., B.Sc., McGill Univ., '06; 1903, (Summer) engr'g. staff, Cobalt Sect. of Temiskaming & Northern Ontario Rly.; 1904, (summer), engr'g. staff in chg. of grades and track centres and ballasting 30 miles; 1905 (summer), hydraulic field work, Georgian Bay Ship Canal Survey and chg. investigation Chaudiere Water Power Plants; 1906, (6 mos.), supervising constrn. of various plants for T. Pringle & Son, Mill Engrs., Montreal; 1907, on estimates for E. A. Wallberg, Montreal, contractor on Intercolonial Shops at Moncton and (9 mos.), engr., Eastern Constrn. Co., 52 miles grading Transc. Rly.; 1908, res. engr., Grand Falls Power Co., N.B.; 1908 (Nov.-Dec.), report on water powers Ottawa river, Georgian Bay Ship Canal survey, Public Works Dept., Ottawa; 1909 (Apr.-Dec.), engr. in chg. foundation work, Haney, Quinlan & Robertson, Winnipeg, Man.; 1910 (Jan.-May) engr'g. work, design and installn., concrete layouts, gravel plants, etc., and (June-Sept.), in chg. field party on location of logging railway at Three Valley, B.C.; 1917, pvte. practice and legislature civil engr'g., investigation water powers, mill sites, etc.; 1918, military service, trained for commission, Canadian Engineers Depot, C.E.F., Brockville, Ont.; at present, pvte. prtce., civil engr'g., New Westminster, B.C.

References: G. A. Mountain, J. B. McRae, W. Young, H. K. Dutcher, A. E. Foreman, P. Philip, F. S. Keith, R. S. Lea.

EASTON—FRANK STEWART, of Mexico City, Mexico. Born at Glasgow, Scotland, Feb. 5th, 1884. Educ., B.Sc., (Eng.) with distinction, Glasgow Univ., '06; 1903-04, asst., office Prof. Longbottom, Royal Tech. Coll., Glasgow; 1904-05, asst., office R. W. Dron, A.M. Inst. C.E., engag'd., on coal mining, roads and drainage, works; 1905-09, asst. engr., under Mr. Jas. Bell, M. Inst. C.E., office work, field work, design and constrn., steel and masonry bridges and bldgs., harbour works, rly. structures, and 1909, on design and erection bridge renewals under traffic and repairs and strengt'ng., long viaducts; 1910-11, asst. engr., ch. engr's. office., G.T. Rly., Winnipeg, Man.; 1911-19, asst. hydro-electric engr., B.C. Electr. Rly. Co., under W. V. Hunt, hydro-elect. engr., and G.R.G. Conway, M. Inst. C.E., ch. engr.; 1919-date, ch. civil engr., chg. re-constrn. track system and new constrn. and mtce. of rlys. and bldgs., and investigation new water power projects., Mexico Tramways Co., Mexican Light & Power Co., and subsidiaries, Mexico City, under G.R.G. Conway, M.E.I.C., Mng. Director., Mexico.

References: G. R. G. Conway, F. W. Teele, C. Brakenridge, W. Anderson, A. C. Eddy, A. D. Creer, J. Muirhead, D. O. Lewis, E. A. Cleveland.

McLEAN, HENRY JOHN GIBSONE, of Brantford, Ont. Born at Brantford, Ont., June 6th, 1888. Educ., I.C.S. and School of Accountancy; 1904-08, app'tceship, in factory and drawing office, 1908-10, dftsman, 1910-15, ch. dftsman, supervision of design of engines, boilers, road rollers, sawmills, etc., including arch'tre and layout of mills, Waterous Engine Works Company, Limited, Brantford; 1915-19, military service as follows: second in command, Platoon Commdr., and Educational Officer, Canadian Inf. Bns.; 1919-20, Deputy Asst. Director, Eastern Ontario, Dept. of Soldiers Civil Re-establishment; 1920-21, paper making machinery and hydraulic turbines, Dominion Engineering Wks., Ltd.; at present consulting engr., Temple Bldg., Brantford, Ont.

References: G. E. Bell, C. D. Collins, G. B. Hughes, C. A. Waterous, D. G. Anglin, H. E. Bates, F. C. Wilkes.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

OSLER, CHARLES ERNEST, of Montreal, Que. Born at Kingston, Ont., June 22nd. 1886. Educ., Montreal High School and Abingdon College; 1904, dftsman, struct'l. Steel work, Phoenix Bridge Co.; 1905, constrn. dept., Montreal Light Heat & Power Co.; 1906, dftsman, Nat. Transc. Rly., and 1907, leveller; 1907-11, detailing and designing in chg. structr'l. steel work, Structural Steel Co.; 1911-12, chg. detailing and design'g., Nat. Bridge Co.; 1912-16, asst. engr., on Quebec Bridge constrn.; 1916-17, design'g. engr., Shawinigan Power Co. 1917-18, ch. engr., Three Rivers Steel Foundry plant; 1918-20, principal asst. to Bridge engr., Grand Rrunk Rly.; 1920 to date, inspecting engr., G.T. Rly. system, Montreal.

References: G. F. Porter, C. M. Goodrich, M. B. Atkinson, H. R. Safford, H. Rolph, F. P. Shearwood.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

HEENEY—TERRENCE JAMES CLIFFORD, of Montreal, Que. Born at London, Ont., Jany. 17th, 1894. Educ., 3 yrs. McGill Univ.; 1915, meter install'n. and testing and general repairing, Hydro-Electric Power Comm., London, Ont., and sub-foreman of installn. and mtce., Power Dept. Montreal Tramways Co., Montreal; 1918, Lieut., Canadian Engineers, Canadian School of Military Engr'g., Seaford, England; 1919 to date, asst. to cable engr., in chg. of design and manufacture of Power & Telephone Cable in engr'g. dept., Northern Electric Co., Ltd., Montreal.

References: W. C. Adams, W. B. Cartmel, W. H. Eastlake, N. L. Morgan, T. E. Wilmot, W. G. Tyler.

THE

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CONTENTS

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VOLUME V MONTREAL, OCTOBER 1922 NUMBER 10

Report of General Professional Meeting

Winnipeg, Man., September 5th, 6th and 7th, 1922.

An adjournment of the 36th Annual Meeting.

The General Professional Meeting of *The Institute*, convened as an adjournment of the 36th Annual Meeting, opened at the Fort Garry hotel, Winnipeg, on Tuesday, September 5th, at 10.00 a.m., President J. G. Sullivan in the chair. After declaring the meeting opened, President Sullivan called on Mayor F. O. Fowler, who extended a cordial welcome on behalf of the city of Winnipeg to the members gathered in convention. He paid a warm tribute to President Sullivan, stating that he appreciated John Sullivan's opinion as much as he did anybody's in the world, pointing out that he was an example of one who was giving the benefit of his experiences to the community. He further pointed out that, generally speaking, the engineering profession was self-sacrificing, giving its services to the public, to the community, and to the world generally without reaping all the reward. He spoke in glowing terms of the work of General Ruttan, Hon.M.E.I.C., formerly city engineer, and emphasized how fortunate the city of Winnipeg had been in getting the benefit of his engineering experience and good judgment. After outlining the earlier engineering features of the city of Winnipeg, Mayor Fowler stated that the service the engineering profession was doing for the world is not generally appreciated because it is invaluable. In concluding, he again extended a warm welcome.

President's Address

Gentlemen:

If this meeting was held at the beginning of our fiscal year, as is usually the case, I could address you on the subject of the merits of the outgoing officers, and on the work we hoped to accomplish. That would not be an appropriate subject at this period of the year, and as you are to hear later, from a very prominent member, a discussion on Society Affairs, I will not trespass on that ground, but will confine my remarks to a subject which effects the individual welfare of our members. The first and principal motto of our association is:—

> "To facilitate the acquirement and interchange of professional knowledge among its members, and to enhance the usefullness of the profession to the public."

This is a laudable and creditable motto and is voicing the sentiment that has meant progress for civilization. In our development the three "C's", *Competition, Combination* and *Co-Operation*, are the most important factors, and if we could only make the latter play the part in our economic problems, that it has in our social development, I feel convinced that the progress of the world would be much greater.

Engineering has been defined as the art of making a dollar earn the greatest amount of interest, and an engineer has been described as one who can accomplish with one dollar what an ordinary man can do with two; also as one who can make two blades of grass grow where one grew. This is all very flattering and possibly true to a more or less degree, but my experience and observation has convinced me that ninety-nine per cent of our work consists of supervising and directing the expenditure of capital, and further anything that obstructs or retards the accumulation of capital, and the investment of the same directly effects the welfare of the engineer. As a consequence the engineer is more vitally concerned in economic problems and conditions than the majority of

members of other professions. I would like to leave with you a few thoughts on this subject that would stimulate an interest in the same, and cause you to further study the matter. In the first place, how many of us ever give a thought as to what capital really is, and what are its limits? Possibly the best definition of capital is "stored labour". If that is accepted, it is not unnatural to be impressed by the statement we hear nearly every day to the effect that all capital is the result of labour. If you give a little study and thought to this matter, I believe you will come to the conclusion that this statement is not true, but rather that capital is the result of self-sacrifice and self-denial. If you pursue the study further you will be greatly surprised at the small amount of capital in the world, that is, the small saving we have made,—in five or six thousand years of historical times less than $600.00 per capita for the present population of the world. A further study will disclose the fact that the annual increase is very small. When you get these facts firmly fixed in your mind you will realize the absurdity of the false teaching that there is plenty in the world for all to live in ease and luxury, if the capital of the world was more equally distributed. You will realize the fallacy of the teaching that the man who labours with his hands produces from two to twenty times the amount for which he is paid; the fallacy of the teaching that the employer has unlimited resources, and that conditions can be improved by men lying down on their work and doing very little in the belief that the less they do the more jobs there will be erected for others. The demand for men during the World War has provided the opportunity for the radical socialistic agitator to put into practice some of his false teachings, and we can see the results in the general unrest all over the world, and the effect on the individuals of our profession is too apparent to require any further elucidation on my part. To sum up, the points I wish to make are as follows:

1st. The principal work of the engineer is the supervision and the construction and operation of works, for the benefit of mankind, made possible by capital.

2nd. Capital is created by self-sacrifice and self-denial.

3rd. Capital is limited and is not rapidly increasing.

If you agree with me this far you will, I think, see that it is to your interest to study the economic problems of the world, and I know if the engineers turn their attention to the problem they will come to the conclusion that the solution of our difficulties can only be by co-operation between capital and labour. If the engineers of the world reach this conclusion, it will only be a matter of time when we may expect the world's progress to increase instead of being at a standstill, as has been the case for the past decade.

E. V. CATON, M.E.I.C.
Chairman of the Winnipeg Branch.

GEO. L. GUY, M.E.I.C.
Secretary-Treasurer of the Winnipeg Branch.

Discussion on Institute Affairs

After concluding his address, President Sullivan said it had been anticipated that one of our vice-presidents would be present and give a talk on Society Affairs, also that J. B. Challies, M.E.I.C., chairman of the Committee on Policy, who had done great work for *The Institute*, would review the work of his committee. In their absence he called on the secretary to lead the discussion. Before commencing his remarks the secretary read a telegram just received from Vice-President Francis, conveying his unbounded regret to President Sullivan and the members at his not attending because of pressing public appointments. At the commencement of his remarks he con-

gratulated the Branch on the fact that the Winnipeg Branch had as one of its members an Honorary Member of *The Institute*, General Ruttan, one of the charter members of the Canadian Society of Civil Engineers, and on the fact that the president of this year was one of the Branch's esteemed members, and in the third instance, because of the splendid programme provided for the Professional Meeting. He then proceeded to review the report of the Committee on Policy, pointing out the more important suggestions of the committee, and their effect upon *The Institute*. The president then opened the meeting for discussion on Institute Affairs.

Alex. Dawson, M.E.I.C., noted the difference between the meetings of *The Engineering Institute* of to-day and those of twenty-five years ago, the young men of to-day taking a much more active and prominent part than was permitted a generation ago. He advised the younger men that they would only get from *The Institute* in direct proportion to the service they rendered. He believed that we should concentrate our efforts in assisting the younger men of the profession, referring to the scholarships offered at the University of Alberta by the Association of Professional Engineers of Alberta, expressing his opinion that we would do well to establish student chapters similar to those of the American Society of Civil Engineers.

Major G. A. Walkem, M.E.I.C., observed that as a practicing mechanical engineer, he had not found the returns satisfactory, and consequently he had branched into the commercial side, and while reluctant to advise professional engineers, he believed that those who could afford it should devote some of their time to non-professional activities, as by so doing, a great deal could be done to advance the status of the engineer. He believed the engineer was in a position to demand the returns due him. He believed that we should take a greater interest in the younger members of the profession, helping them to secure proper positions, and also proper renumeration. He hoped to see the day when *The Engineering Institute of Canada* would be in the same position as the Institution of Civil Engineers in England, and would be the authority to which the federal government would go when requiring advice on matters of engineering. He believed the engineer could make himself more prominent and take his place beside the banker and other men who seemed to wield all the power.

Geo. W. Craig, M.E.I.C., on rising to discuss engineering ethics and welfare, first paid a tribute to General Ruttan, and moved that the secretary convey to General Ruttan the greetings of the meeting, and regrets that he was unable to be present on account of ill health. The motion was seconded in toto and carried unanimously. Continuing, Mr. Craig expressed the strong belief that we should have a code of ethics to which all could subscribe as one of the strongest means of placing the engineering profession in its proper position in the eyes of the public. At present the engineer's position is not much better than that of the common laborer, largely because he had not taken a firm stand in insisting on, and fighting for what he knew to be his right. He quoted a remark of William Pearce, M.E.I.C., to whom he referred as one of the finest men in the profession, the day after he arrived in Calgary to take his present position. "When you make up your mind that you are right take a stand, we are with you". He believed that every member of *The Institute* should study the subject of ethics, master those ethics, and practice them, because hardly a day goes by that we cannot render service to our brothers in the profession, if we so desire. Engineers should fight the battles of their fellow members where abuses exist.

Charles Gray, A.M.E.I.C., expressed his appreciation of the addresses of His Worship the Mayor, and President Sullivan. He believed *The Institute* was in a position to do much for its members and be of great assistance to the men if they so desired it. He had very strong views on the question of the place the engineers should take in public life, believing they should be active in that direction, instancing that engineers should put their knowledge and views before the other members of the community, on problems dealing with the elemental forces of nature. Because the engineer had been so interested in his work

D. A. ROSS, M.E.I.C.
Chairman of Programme Committee.

he had not found time to take up active public work. He believed that the large expenditure of public moneys in municipalities should not be left in the hands of the other citizens, but that the engineers should be leaders. In the past doctors and lawyers had held the epitome of public opinion in their hands. He believed that engineers should be jealous of the status of the profession, and at the same time bring themselves more prominently before the public, letting the public know what they are doing and what the engineer is really worth. He urged the engineers, and particularly the rising generation, to put their minds on active public service, even though it meant a sacrifice. It was good training and splendid experience and a wonderful reminder of ones duty to his follow men.

P. Burke-Gaffney, A.M.E.I.C., asked when some action might be expected on the adoption of the report of the Committee on Classification and Remuneration. He

pointed out that it was obviously impossible for engineers to take any part in public life until they achieved some measure of financial independence, which was impossible under existing conditions. The secretary pointed out that the report of the committee was received by Council some months ago, and had been referred to the Executives of the various Branches, mentioning that action in dealing with the report had been withheld at the request of the Ontario Provincial Division. The present position was that the report was before the Executives of the Branches and now the Committee on Policy made definite recommendations in that connection.

Thos. L. Roberts, M.E.I.C., believed that schedules for professional work should be adopted without further delay, it being very difficult for a man practicing for himself to say what his fee should be for certain work. James Milne, M.E.I.C., stated that this was a very important matter as a man might get certain percentages but according to the ethics in vogue with some engineers they are willing to do the work for two and one-half per cent less. President Sullivan thought *The Institute* would be well advised to get ethics properly established before trying to enforce schedules.

As the time for discussion had expired, President Sullivan read an invitation from the Southwood Golf Club, to members of *The Institute*, to avail themselves of the privileges of the club; also the Old Colony Club extended its privileges. Geo. W. Craig, M.E.I.C., then moved, seconded by D. A. Ross, M.E.I.C., that this meeting approve of the report of the Committee on Policy and recommend it to the Council of *The Institute*. Discussing the motion, Mr. Ross expressed his strong feeling that the adoption of the report of the Committee on Policy was a move in the right direction. The motion carried unanimously. The meeting adjourned at 12.45 p.m.

Luncheon at Fort Garry

As guests of the Association of Professional Engineers of the Province of Manitoba the members were entertained to luncheon at the Fort Garry hotel at which D. A. Ross, M.E.I.C., president of the association, presided. The courtesy of the Professional Association in thus entertaining the members assembled was greatly appreciated. At the luncheon the Hon. F. M. Black, provincial treasurer of Manitoba delivered a splendid address.

Hydro-Electric Development

The chair was occupied by Professor E. P. Fetherstonhaugh, M.E.I.C., immediate past-president of the Branch who called on E. V. Caton, M.E.I.C., who read his paper on "Extensions to the Hydro-Electric System of the City of Winnipeg", as published in the September *Journal*, commencing at page 441. Mr. Caton illustrated his talk by numerous lantern slides.

Manitoba Power Company's Development at Great Falls

F. H. Martin, M.E.I.C., chief engineer and designer of the Manitoba Power Company then gave a description of the development, illustrated by numerous slides.

The Development Described

The Great Falls plant is seventy-five miles from Winnipeg and is reached by the Canadian Pacific Railway via Molson, thence a distance of twenty-two miles to Lac du Bonnet, the terminus of the Canadian Pacific branch line. The present plant of the Winnipeg Electric Railway Company is seven miles south-east from Lac du Bonnet, access being gained by motor boat and automobile to Pinawa. From Lac du Bonnet the route is over the power companys' railway due north for thirteen miles. Along side this railway is a double circuit steel tower transmission line, connecting the Great Falls plant with the existing power line from Pinawa. At present, however, power is being transmitted over this line to Great Falls for construction purposes.

The Site

At the site selected for the Great Falls development the river is divided into two channels by an island, known as Island No. 2, which greatly facilitates construction. The dam and power house under construction at this point will raise the present water level 46 feet, and form a pond or reservoir 2,000 acres in extent, reaching upstream a distance of five miles and flooding out the existing rapids. It had been ascertained, however, that by excavating a channel 200 feet wide, 20 feet deep and approximately 1,800 feet in length, through a rock reef at White Mud falls, two and a half miles down the river from Great falls, the entire reach of the river between the power site and White Mud falls can be lowered ten feet or more, thus making a total operating head on the plant of 56 feet, for which head the turbines are designed.

The Dam

The first portion of the dam will extend from the end of the railway on the west bank to the power house and will be of solid concrete with a maximum height of 60 feet, and a width at the top of 9 feet, affording an entrance walk to the power house. The main dam will extend from the east end of the power house across the island and the east channel, and up the east bank, a total distance of 3,500 feet. In this portion of the dam will be included skimming weirs, log slide, fish ladder, 400 lineal feet of free spillway and four large sluice gates, each 30 feet high and 50 feet wide, capable of discharging the entire flow of the river under flood conditions. The remaining portion of the dam is made up of 400 lineal feet of concrete non-over-flow dam on the island, 1,000 lineal feet of rock-fill dam with clay facing across the east channel and 1,200 lineal feet of earth embankment with concrete core wall on the east bank.

Power House

The power house will be 110 feet wide, 380 feet long and have a maximum height of 145 feet. The foundations are of reinforced concrete and will carry a structural steel superstructure with concrete curtain walls provided with steel sash. The roof will be a concrete slab covered with felt roofing. The power house proper will contain six vertical turbo-generators with the usual intake racks, stop logs, head gates, etc. At the entrance to the scroll case for each unit, three pairs of steel head gates will be provided. Gate openings will be sufficient to pass flow required for each turbine at a velocity of 4.5 feet per second. Screens consisting of heavy steel bars, 6-inch spacing, supported on a steel framework will also be placed in the intake. Stop logs will also be provided

at the entrance to the water passages for closing off the water to facilitate inspection and maintenance of the gates.

Initial Development

The initial installation is to include the power house building complete to accommodate three units. The sub-structure of the balance of the power house, for the accommodation of the remaining three units will be completed to such a point as is necessary in order that future extensions may be made without unwatering expense. The electrical installation includes two generators, the third to be installed in the space prepared when required, two banks of transformers and switching equipment for delivering the power to the outgoing lines. The dams and other permanent works will be constructed for the complete installation.

Hydraulic Equipment

The turbines will be of the single runner, vertical shaft, diagonal or propeller type, and will develop 28,000 h.p. when operating under a head of 56 feet and running at a speed of 138.5 r.p.m. Under these conditions the guaranteed efficiency is 87%. The runaway speed of these turbines when operating under full gate opening and under the effective head of 56 feet will be about 315 r.p.m. The full weight of the revolving parts of the turbine including hydraulic thrust, not including the generator field, is about 600,000 pounds. The shipping weight of each turbine with its accessories is 725,000 pounds. The water enters the turbine through a concrete scroll case and will be guided into the movable guide vanes by individual stay vanes imbedded in the concrete at their upper and lower ends. The stay vanes will be provided with foundation bolts and adjusting screws at the upper end for adjusting the cast iron pit liners. The runner will have six blades, cast in one piece with the runner hub. The operating gear to the guide vanes will be of the offset type in which the guide vane levers are offset from their radial position, and as the vanes close the levers turn in a direction still farther away from the radial position resulting in a toggle action, which greatly improves the speed regulations of the unit.

The governors will be of the double floating level type with relay belt drive from the main shaft provided with hand control mechanism and the usual accumulator tanks, connecting piping, tachometer, etc., and electric motor for remote control. The governor will adjust the gates without "hunting" when the speed varies one-half to one percent from normal, and they will be adjusted to open or close the turbine gates in not more than three seconds.

The draft tube will be formed in the concrete and will be of the centrecone spreading type, the centrecone extending upwards to an elevation just below the runner, the upper end being provided with a cast iron cap which will extend through the lower end of the runner cap forming a pedestal for supporting the rotating element of the turbine when the thrust bearing is dismantled.

Electrical Equipment

The generators will be of 21,000 kv.a. capacity, of the vertical type, running at 138.5 r.p.m. The machines will have a guaranteed efficiency of 97.1 percent and reactance of 18 percent. The weight of the machine is
He referred to Messrs. Chace, Scott, and Brereton.

480,000 pounds with flywheel effect of 10,000,000 pounds feet square. These machines will generate three phase, sixty cycle, alternating current at 11,000 volts, and will be provided with 150 k.w. direct connected exciters.

The entire revolving element of the unit will be supported by a Kingsbury thrust bearing mounted on top of the generator stator. This bearing has a capacity of 950,000 pounds at a speed of 138.5 r.p.m. and is provided with water-cooling coils and the usual valves, thermometers and indicating devices which are customarily furnished with these bearings.

The transformers will be 7,000 kv.a. each single-phase, water-cooled, 11,000/63,500/110,000, with taps in the high tension winding to give 10,000 volts reduced capacity in the low tension windings. The guaranteed full load efficiency is 98.8 per cent regulation at full load and unity power factor is 1.5 per cent and impedance approximately 9½ per cent. The temperature rise at full load until constant is 55 deg. C. The insulation test high voltage to low voltage winding and core is 170,000 volts, and from low tension windings to core 25,000 volts. The voltage across full winding is twice the normal. Each transformer requires 2,000 gallons of oil, weighing 17,300 pounds. The weight of the transformer less oil being 30,000 pounds. The height over the leads is 200 inches and over the cover 145 inches. The floor space covered being 92 inches by 99 inches.

Each generator will be connected direct to the low tension side of its transformer bank without any intermediary oil circuit breakers or busbars which virtually makes each generator and its transformer bank one unit. The high tension oil circuit breakers connecting the transformer to the high tension busbars and line are of standard G.A. 3 type, 73,000 volts with interrupting capacity of 5,600 amps, and each switch is provided with automatic overload trip.

General

The design of the plant is modern in every respect and in physical dimensions and quantity of water used the turbines are among the largest for which contracts have ever been awarded. The physical cost for the initial installation including all permanent works for the complete development is less than $100 per h.p., and for the complete plant will be less than $60 per h.p., which is undoubtedly the lowest unit cost yet recorded on this continent for a plant of this magnitude.

The plan of development is in accordance with the general scheme of the Water Power Branch of the Dominion Government and forms the principal link in a chain of potential developments extending from the Lake of the Woods to Lake Winnipeg.

The contractors for the work are the Northern Construction-Fraser, Brace, Limited, who have successfully completed other large construction jobs of a similar nature.

Discussion

Mr. Caton mentioned the fact that the city's plant was very intimately connected with *The Institute* as three of the past-chairmen of the Branch had been responsible for the actual work on that development and on that foundation the success of the present plant had been laid.

F. H. Martin, M.E.I.C., asked Mr. Caton if the gates described could be closed when the units are in operation,

to which Mr. Caton replied that, starting with a unit running on full load and the gates wide open, with the head gates on the carrier, they could be placed in position within less than fifteen minutes from the time started, and while that might seem a long time, it was not a question of time but a question of saving about fifteen thousand dollars on each unit. James Milne, M.E.I.C., Toronto, inquired regarding the cost of the finished product in order that comparisons might be made between the work being done here and elsewhere. He mentioned the difference between the position Winnipeg was in, in having the power absolutely under its own control, and those cities in Ontario where they had no say regarding the operation of the plant. He considered it worth the extra cost to be in the position of independence of Winnipeg. Replying, Mr. Caton stated that the present cost to the city at Point du Bois is slightly under seventy dollars, but with the completion of one hundred thousand horse-power installation it was anticipated that the price would be in the neighbourhood of sixty dollars. Although part of their work was done during the war, the city had a cost-plus contract whereby the contractor was penalized fifty per cent of the excess, and received a bonus of twenty-five per cent of the saving.

Proportioning of Concrete

Major Walkem, of Vancouver, asked Mr. Martin as to his idea regarding pouring concrete and his experience regarding the effect on the strength of concrete by using a very wet mix, sufficient to make it follow a chute on less than a natural angle. Replying Mr. Martin stated that some engineers required in their specifications that the concrete should be very wet. He believed the drier you can make concrete the better and stronger it is. They used a form which was removed immediately after the concrete was placed. While the contractors would like to have the concrete very wet, they insisted on an increase in cement with the wet mix. He personally did not favour chuting. He was strongly in favour of a very dry mixture. Speaking of the water ratio and the strength of cement concrete, Mr. Caton asked if any engineer had evolved a successful plan under a water-cement ratio which the contractor would understand and follow, and how such a contract would be worded. Mr. Martin replied that the answer to Mr. Caton's question lay in a definite specification as to the grading of the mix. A specification calling for a 1–2–4 concrete did not mean anything unless the grading was definitely specified. He mentioned an instance of concrete laid in Massachussetts twenty-three years ago, using a mixture of eighteen to one, the concrete being as strong and dense to-day as any that had been placed since that time. He believed the day would come when aggregate would be purchased in bags in the same way that cement is bought at the present time. His only excuse for tolerating a wet mix was that, due to the extreme amount of reinforcement required in a vertical type wall, it was necessary in order to get the concrete to flow in between the reinforcing. W. P. Brereton, M.E.I.C., instanced the method adopted in connection with the construction of Maryland Street bridge, Winnipeg. Months before commencing operations a series of concrete blocks, six inches in diameter and twelve inches long, were made and tested after twenty-eight days, and the aggregate chosen was the one giving the most economical mix and the required strength, taking into account the water-cement ratio. During the construction of the work every day two blocks were made from the concrete, marked, preserved and tested after twenty-eight days set. The effect of water-cement ratio was very strongly shown in connection with the test of these blocks. In the arch proper, where the greatest strength was required, particular attention was paid to the water-cement ratio. The concrete was poured very dry and thoroughly tamped by competent men. He had found in the heavily reinforced walls, where the concrete had to be poured considerably wetter than in the arch, the strength was very much reduced using the same amount of cement. That in the arch tested as high as three thousand pounds per square inch, and averaged about twenty-six hundred, while in the walls, the strength was from twelve hundred to fifteen hundred pounds to the square inch, the difference being due to the water-cement ratio as far as they could determine.

Additional Points Discussed

In response to a question regarding the design of the racks as to whether it had been necessary to consider full water pressure, Mr. Brereton replied that in considering the design, it was decided that they might sometimes become clogged so that, instead of assuming a factor of safety of three or four, the racks were designed as a dam. So far the racks had not become clogged at any time. Asked as to when they expected to deliver power from the Great Falls plant, Mr. Martin replied that they expected the first unit to be in operation by Christmas, most of the work completed by this time next year, two units being put in at the present time to be followed as soon as possible by the installation of the third, fourth and fifth units, and the whole plant to be completed within the next five years. D. A. Ross, M.E.I.C., referring to the cut in the river at White Mud falls, of two hundred feet, the river being six hundred feet wide, the cut being designed to lower the water an additional ten feet on the lower side of the works, asked Mr. Martin if he considered the two hundred foot cut sufficient to take care of the water in the flood period, so that there would always be the additional ten feet. Mr. Martin replied that the whole matter had been thoroughly considered and that they had some very interesting charts and diagrams and mathematical computations which he was sure *The Institute* would be interested in and which he would be glad to present at some later date. He believed that they could take care of the flood water of the river. It was really a problem of determining the right amount of rock to take out and to estimate the cost of that and balance it against the loss of head through the cut and extreme floods. James Milne, after discussing the various factors in connection with arriving at a rate for electricity, asked for information as to the average cost for power under ordinary operating conditions. Mr. Caton replied that in Winnipeg there were almost as many rates as customers, instancing the Winnipeg Water Works rate as five-eights of a cent per kilowatt hour. He had always argued in favour of a straight kilowatt hour rate. He considered a rate of so much a kilowatt a year as being useless, the governing factor being the total consumption. C. H. Blanchard, A.M.E.I.C., asked what had been the experience in power developments on the Winnipeg river regarding

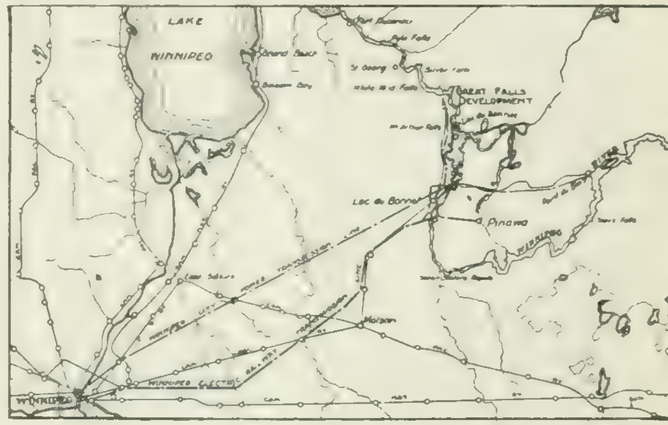
clearing the land where areas were flooded, and if the timber had given trouble where left standing in the flooded area. Mr. Caton stated that the flooded timber area, due to the city plant, was three and one-half square miles, none of which was cleared. It had gradually come off and occasionally appears under the racks. Once a year a diver is employed who goes down to remove some water-logged timber. It had certainly not affected operations sufficient to have warranted clearing the land before the flooding took place, the reason possibly being due to the wide river and the slow current. Continuing the discussion, Mr. Martin mentioned that in the Pinawa development the land had not been cleared and that no trouble had been experienced. At the Great Falls development approximately twelve hundred acres would have to be cleared, a large part of it very heavily wooded with large spruce and poplar, due to government regulations. It was estimated that the revenue from the sale of the timber would more than pay for the clearing. The contract had just been let for a portion of it for cutting the ties and for cutting the timber into cordwood at one dollar and fifty cents a cord. From one acre thirty-seven cords of wood and one hundred and sixty-four ties were obtained, and they were paying from three-fifty to five dollars a cord for wood for fuel purposes. From the result of this experience they had allowed nothing in their estimate for clearing. Major Walkem referred to an experience of the B.C. Electric Railway Company when they built the dam at Coquitlam. Although the land had been cleared, as required by the government, torrential rains flooded lands never flooded before, gathering debris from the logged-off area which broke the dam and washed out the pipe line of the city of New Westminster, so that the city was without water for six months, causing a damage of about two hundred and fifty thousand dollars, illustrating the seriousness of such a situation in a heavily wooded country, as to how well the logs are cleared off the land and the debris collected.

Guests of Winnipeg Branch

As guests of the Winnipeg Branch the members participated in an enjoyable function on the first evening of the meeting. The Motor Country Club, which is the original Lower Fort Garry preserved intact both as to buildings and surrounding fortifications, was the objective. Motor cars provided by members of the Branch conveyed the party from the Fort Garry hotel to the club. The dinner which was served could not be surpassed, and after two hours of social enjoyment the party returned, everyone well satisfied that the first day's proceedings had been an unqualified success.

Excursion to Great Falls and Point du Bois

One of the most interesting days outings ever provided a body of engineers was that of Wednesday, September the sixth, when about two hundred and seventy-five members and others interested, visited the Great Falls development of the Manitoba Power Company Limited, and the Point du Bois plant of the city of Winnipeg as guests of the city of Winnipeg and the directors of the Manitoba Power Company. As excellent papers on both these undertakings had been presented on the previous day, the visitors were in a better position to appreciate all they saw and heard on this memorable trip. In addition to a special train, which left the C.P.R. station at eight o'clock in the morning, lavish entertainment was provided continuously throughout the day. The whole days outing was an illustration of the fact that as hosts and entertainers the westerners excel.



Map of Winnipeg River, showing location of Great Falls development of Manitoba Power Company, Ltd.

The Great Falls development of the Manitoba Power Company was first visited. The accompanying map shows the position of the power site and its geographical relation to the other power plants and to the city of Winnipeg. A handsome souvenir of the trip was distributed containing a description of the plant by the chief engineer, F. H. Martin, M.E.I.C., with a colored plate showing a birds-eye view of the plant contemplated, and embodying greetings from the president, Sir Augustus Nanton, and the vice-president, A. W. McLimont, in part as follows:—

> On behalf of the Manitoba Power Company Limited, we desire to express to the members and guests of *The Engineering Institute of Canada* our sincere appreciation of the honour and privilege conferred upon us in so arranging their programme for the 36th annual meeting as to accept our invitation to inspect to-day our large hydro-electric development now under construction at Great Falls on the Winnipeg river.
>
> The engineering profession realizes, we believe—possibly clearer than any other group of men — how vitally important to the continued growth and prosperity of a community is a reliable source of low cost hydro-electric power. We feel that the development you will see to-day, not only will be of benefit to the Winnipeg district but also will serve as a national asset of primary importance in assisting in the needed industrial growth of the west.
>
> At present the greater part of the manufactured products demanded by the fast growing population of western Canada are secured either from factories 1,200 to 1,500 miles away in eastern Canada, or from nearer foreign plants in the United States. Regardless of their origin the western consumer pays too dearly for such goods.
>
> Winnipeg, located at the threshold of the west, in the very centre of the Dominion, served by better railway facilities than any other manufacturing

district and with an abundance of labour is rapidly developing into a great industrial community and is to-day Canada's third city in value of products and population.

It is instructive to note how Winnipeg's industrial progress has kept pace with the supply of hydro-electric power. It is interesting at this time to recall that when the initial hydro-electric development of the Winnipeg Electric Railway Company at Pinawa — a total of only 7,000 h.p. — was contemplated there were those who predicted it would take many years to absorb all the power. Later when the first development was increased to 10,000 h.p. the ability to dispose of the added power was questioned even more strongly. However, from time to time the growth of industry in this district has necessitated added units in the Pinawa development and now, within less than twenty years from the time the Pinawa plant was started, you gentlemen to-day will see active construction proceeding on the initial units of another hydro-electric plant with an ultimate development of 168,000 h.p.

When the Great Falls development is completed and the power from it, available for commercial use, has resulted in bringing millions of dollars of new capital into this western country, proving an important factor in the development of the natural resources of the country and stimulating every line of industrial activity in the community, one will then be better able to judge of the enterprise and initiative of those pioneers who laid the foundations for this plant. The men who planned the building of the Pinawa plant and now the Great Falls plant, and who have lived to see their faith in the future of this city justified, are just as confident to-day that within a decade all the power from the present plants on the Winnipeg river will be absorbed, and enterprising business men will then be aiding in the establishment of additional power plants to furnish a further supply.

The engineers of the company are: — supervising engineer, Julian C. Smith, M.E.I.C.; consulting engineers, L. J. Hirt, M.E.I.C., R. S. Lea, M.E.I.C., and C. O. Lenz; chief engineer, F. H. Martin, M.E.I.C.; assistant engineer, T. W. MacKay; resident engineer, T. Lewis; and assistant resident engineer, B. S. MacKenzie, M.E.I.C. The contractors are Northern Construction — Fraser, Brace Limited, president, J. M. Brace, M.E.I.C.

On arriving at the site the party was given ample opportunity of inspecting the works, construction of the dam and power house being well under way. Luncheon was served in one of the dining rooms of the company where the party, as guests of the company, was given an excellent meal from the electrically equipped modern kitchen. On behalf of the company, A. W. McLimont extended a cordial welcome to their guests and expressed the pleasure it gave them to be able to entertain a group of engineers who would appreciate the work being done. J. H. Brace, M.E.I.C., gave a description of the work from the contractor's view point, all modern engineering skill being adopted both in the construction and the equipment. President Sullivan, on behalf of *The Institute*, voiced the feelings of all present in a brief expression of sincere thanks.

Trip to Point du Bois

Immediately after lunch a group photograph was taken, following which the party proceeded to Point du Bois, where the modern plant owned by the city of Winnipeg is located, details of which were given in the paper on the plant by E. V. Caton, published in the September *Journal*. Arriving at the plant, the visitors were given a demonstration of municipal ownership at its best, under the able management of J. G. Glassco, M.E.I.C. In addition to the plant, Point du Bois embodies a modern village owned by the city of Winnipeg, the ladies of which had prepared a magnificent banquet which awaited the party on their arrival at 5.30 p.m. The scrupulous cleanliness of the entire plant was a matter of universal comment, and no banquet hall offered a finer setting to the score of tables with their charming attendants than the turbine room of the plant where the meal was served immediately after arriving. A handsome souvenir of the City of Winnipeg Hydro-Electric System was presented to each guest with the manager's compliments, giving the history and development of the plant by J. G. Glassco, M.E.I.C., and E. V. Caton, M.E.I.C.; and containing a large number of beautiful illustrations. At the conclusion of the dinner on behalf of the city, Mr. Glassco welcomed his visitors in abrief address to which President Sullivan replied expressing sincere thanks to Mr. Glassco for his kindness and hospitality. A toast to the ladies was proposed by D. A. Ross, M.E.I.C., which was responded to by all present giving three hearty cheers. After two hours inspection, the party was escorted to the station and given a rousing send off by the entire populace. The special train containing the party arrived at the C.P.R. station, Winnipeg, shortly before midnight, the unanimous opinion being that it had been one of the finest outings imaginable.

Session of Thursday Morning, September 7th

Civil and Geological

Owing to the number of papers to be presented, the morning and afternoon sessions of Thursday were divided into two sections. In the morning, the sections were civil and geological, and in the afternoon, civil and mechanical.

At the morning civil section, the chair was occupied by John Porter, M.E.I.C., who called upon S. B. Wass, M.E.I.C., who read his paper, "Improvements to Moncton Yard and Engine Facilities" published in the September *Journal*. In response to a question regarding the use of a stiff legged derrick, Mr. Wass explained that it was used to excavate the foundation for the reinforced culvert, being simply built upon a frame, carried on a grillage on rollers, and was hauled back from the excavation under its own power as it completed one section. With this method there was no difficulty even on soft ground, when the timbers were properly put down, in making excavation.

Fred. Newell, M.E.I.C., then read his paper "Automatic Box Car Unloaders for Grain" as published in the September *Journal*, and owing to the lateness of the hour there was no time for discussion.

At the geological section meeting the chair was taken by J. M. Leamy, M.E.I.C., who called upon G. R. Pratt, A.M.E.I.C., to read his paper "Fuel Values of the Coals of Alberta." Economy in the burning of fuel was illustrated in a number of slides, following which Mr. Pratt pointed out that economy was not always the first consideration, for, in the case of public utilities, continuity of service was the main consideration and economy secondary in the case of a crisis.

Civic Luncheon

Following the morning session the automobile committee had an ample supply of cars waiting to convey the members to Assiniboine Park where a civic luncheon was tendered to over two hundred members and invited guests. For the second time during the progress of the convention, Mayor Fowler conveyed a welcome on behalf of the city and again eulogized the engineering profession in glowing terms. An able response in the name of *The Institute* was made by Major G. A. Walkem who is an alderman for the municipality of Point Grey, B. C.

Session of Thursday Afternoon, September 7th

Mechanical Section

The chair was occupied by Professor N. M. Hall, M.E.I.C. In the absence of H. S. Van Patter, A.M.E.I.C., his paper, published in the September *Journal*, describing the twenty-eight thousand horse power turbines for Great Falls development, Manitoba Power Company, was read by Geo. E. Bell, M.E.I.C., manager of the Dominion Engineering Works. The discussion which followed the reading of the paper brought out a number of points in connection with the design of propellor wheels, and a number of questions were answered by Mr. Bell regarding the manufacture and development of the particular type about to be installed. The chairman thanked Mr. Bell for reading the paper and for adding so much to the discussion.

Civil Section

The chair was occupied by Professor J. N. Finlayson, M.E.I.C. In calling on M. A. Lyons, A.M.E.I.C., chief engineer of the Manitoba Highways Commission to read his paper, the chairman stated that he needed no introduction to the members of *The Institute*.

Consideration of a Road Policy

This paper, as published elsewhere in this issue, was in the hands of the members in advance proof form, and was not read entirely by its author who dealt with the main features. He explained that one of his reasons for naming his paper as he had was because *The Engineering Institute*, following a resolution of a professional meeting at Saskatoon a few years ago, had appointed a committee to draw up specifications, including a road policy.

In Manitoba, the roads were handled under two organizations. The Reclamation Branch dealt with opening up new country and colonizing roads and the Good Roads Board dealt with the roads in the older municipalities with the idea of improving roads which had already been used for some time. To get assistance from the government under the Good Roads Act it was necessary for a municipality to lay out a scheme of roads and make application to the board. The board sends out an engineer who makes a study of their proposal and an estimate of the cost, suggesting changes he may think advisable. Conferences between the board and the municipality are held until a road scheme, mutually satisfactory, is arranged. The municipalities have three methods of financing: — first, to pay the costs out of current revenue, second, by special tax, and the third, by an issue of debentures for their share, and the share debentures must not exceed the engineer's estimate of the municipality's share of the cost. Where debentures are issued, after the scheme has been approved by the board, the work can be advertised and contract let subject to the approval of the board. Most of the work is done by contract.

There are two classes of roads, market roads and provincial highways. The selection of a provincial highway remains under the influence of the board, the government paying two-thirds of the cost of construction and maintenance. On market roads, if they are gravelled, they pay one-half of the cost, and on earth roads one-third of the cost. The government also pays one-half of the cost of concrete and steel bridges, and one-third of the cost of wooden bridges. Maintenance is left pretty much to the municipality, and while some look after maintenance well, others are reluctant to spend the necessary money. Up to the present there are about five thousands miles of roads brought under the Good Roads Act, and on market roads the total amount expended up to the end of 1921 was four million two hundred thousand dollars, of which the government paid one million nine hundred thousand dollars. On provincial highways there has been spent one million five hundred thousand dollars of which the government paid slightly over one million dollars. On pavements around the cities, of nine hundred and eighty-four thousand dollars spent, the government paid three hundred and twenty-four thousand. On bridges, the most of which are concrete, the total cost to the municipalities has been one million two hundred thousand dollars and the government has paid five hundred and eighty-nine thousand. Up to the end of 1921, the total mileage of roads made since the beginning of the Act was two thousand eight hundred and fifty-five; the total mileage gravelled was nine hundred and fifty-three; the total mileage paved twenty-four; the total number of bridges and culverts, seven hundred and eighty.

After showing a number of slides illustrating the country through which the roads were being built, Mr. Lyons pointed out that one of the weaknesses of the present system is that it is very difficult to get a complete through highway built.

Professor E. F. Chandler pointed out the fallacy in locating roads along township lines, instead of following the contour of the ground, pointing out that where a section line includes a steep grade, the road is built there regardless of the fact that by the purchase of a few acres of land, the road could be built where it naturally belonged, saving ten times the subsequent expense and ten times that amount per year in economy in transportation.

C. W. Dill, M.E.I.C., formerly chief engineer of the department of highways of the province of Saskatchewan,

congratulated Mr. Lyons on his paper. He referred to conditions in Saskatchewan and to a paper, presented by him at the professional meeting in Saskatoon a year ago, in which he had outlined a number of restrictions regarding the use of the road that were in effect in New Brunswick, where the roads are absolutely under government control. He mentioned the difficulty of keeping people off roads at a time when traffic should not be allowed, except from great necessity. He cited a case of a motor truck running on a road from Regina to Moose Jaw, which had been built as a demonstration road, irrespective of the condition of the road. It had made a rut from three to eight inches deep practically the whole length of the road. A farmer will draw a tank load of wheat the whole way to the elevator when the roads are wet, doing more harm on one trip than they could do good in maintaining the road for the whole year. The maintenance of an earth road costing from fifteen hundred to four thousand dollars a mile being a serious matter, he had endeavoured to get people interested by showing them that the amount expended for maintenance was the same as paying a premium on an insurance policy to keep active the investment. Owing to the high cost of gravel over the greater part of the prairies, (it would take about three years to build a gravel road), the additional cost of a hard surface road would be so little that it would not really pay to gravel most roads, citing particularly that between Moose Jaw and Regina.

Asked as to a fair estimate of maintaining an ordinary gravel road, Mr. Lyons replied that it depended on the road, the traffic and the location, and considered a gravel road after five years pretty well worn out, the base being there but requiring an additional coat of gravel. In Wallace municipality where there were good roads on light soil, and the traffic not very heavy they spend about twenty to twenty-five dollars per mile. In Rockwood with similar traffic and gumbo a little heavier, about forty dollars a mile, this being for dragging only, the road not being kept in first class condition. It was essential to drag the road after heavy rain, and a new coat of gravel, practically every year after the first year. Asked as to his experience in using oil on gravel roads, he replied that nothing had been done in the province of Manitoba.

Mr. Dill stated in connection with the oiling of roads, that he had written chief engineers of a number of north western states to get information on that subject, and had found that all of them were rather against the idea, except as a local treatment for the year in which it was done. Oil laid in the springtime was good until the fall rains or until the frost, being simply more or less of a dust eradicator for the summer months. Mr. Milton referring to Mr. Chandler's suggestion, pointed out that a road was being built by the Good Roads Board to Point du Bois, and instead of following the township line was following the natural conditions of the ground. President Sullivan considered Mr. Chandler's suggestion a good one, having often thought it would be a good plan to have the country cut up into sections eight miles to a side, running the roads diagonally. Mr. Lyons said that it was very easy for engineers to see the benefit of such a method, both in saving of distance and cost of hauling, but those who would be benefited most could not see it that way. He referred to the fact that the Dominion government, when Manitoba entered confederation, was supposed to make a survey of all the old trails and turn them over to the province, but in many cases, in giving titles they had omitted to reserve the road. Some had been closed up and reopened again. The old trails would make excellent highway routes, but it was going to be a difficult matter to use them.

The chairman then thanked the author and those who took part in the discussion.

The Chemistry of Portland Cement and its Disintegration by Alkaline Ground Waters

In introducing Dr. T. Thorvaldson, professor of chemistry of the University of Saskatchewan, Chairman Professor Finlayson, M.E.I.C., stated that about a year ago the committee of *The Institute* appointed to investigate the action of ground waters on concrete in the prairie provinces had looked around for a chemist and had been fortunate in securing the services of Dr. Thorvaldson, who had given a year of his time to the problem. Dr. Thorvaldson then read his paper on the Chemistry of Portland Cement and its Disintegration by Alkaline Ground Waters as published in the September *Journal* page 457.

Work of Institute Committee

Following the reading of his paper, Dr. Thorvaldson advised that he had been requested to give a very brief summary of the chemical research work which is being carried on at the University of Saskatchewan on the problem of the action of alkaline ground waters on concrete.

You probably all know that a committee of your Institute under the chairmanship of Dean C. J. MacKenzie, M.E.I.C., and with membership from the three prairie provinces is responsible for the conduct of this investigation, and that the chemical work in connection with it, has been in progress for one year, while the field investigation in charge of Professor G. M. Williams has already extended over a somewhat longer period.

This investigation may be considered in three stages, the first being a study of concrete in the field under alkali conditions and the study of ground waters with a view of establishing whether the action of alkaline ground waters does cause failure of concrete of good quality, we may consider that this stage has been passed, for it has been established without a doubt that the best of concrete will fail under severe alkali conditions. The second stage deals with the exact determination of what constituents in the ground waters cause the deterioration of concrete, and what happens when concrete goes to pieces through the action of ground waters — namely a study of the chemical reactions which take place in concrete during alkali action. The third and the final stage, will be to discover a means of preventing the action, or the development of substitutes for the building materials at present used where alkali conditions are severe.

Your committee has decided that it is advisable to attempt to diagnose the disease before we proceed to seek remedies. This decision is partly due to the failures met with by all of those who have been groping around in the dark for remedies. We may therefore consider that the investigation is at present at the second stage while we have hopes of soon proceeding to the third stage.

The method of attack involves the preparation and the study of the chemical behaviour of all the substances

present in cement systems when acted on by solutions of the various salts present in the soils of alkali districts. Also the study of the chemistry of cement systems which have been disintegrated by the action of alkali salt solutions. This includes a study of the solidities of all the substances which may be present in such systems, as well as the chemical reactions which take place when they are in contact with the solutions concerned. We have already studied in this way the oxides and hydroxides of iron alumina, calcium and magnesium, the carbonates of calcium and magnesium silica, hydrated silica, some simple silicates and some other substances. We are at present engaged in the study of the three most important compounds of Portland cement, namely, tricalcium silicate, dicalcium silicate and tricalcium aluminate in alkaline salt solutions.

Numerous series of experiments are in progress for the direct study in the laboratory of the action of salt solutions on cements, mortars and concrete and the chemical changes which take place during this action. We are also studying the colloidal changes which take place during the action of these waters on concrete.

In this work we are using in close co-operation both chemical and petrographic methods. What we cannot see under the petrographical microscope we attempt to elucidate by chemical methods and when possible we confirm by microscopic study the conclusions of the chemical experiments.

We hope that by these methods of attack we may gain an understanding of the chemical changes which take place when concrete disintegrates through alkali action, and that this knowledge when gained may direct our search for a successful remedy.

Discussion

Opening the discussion Dean C. J. Mackenzie, M.E.I.C., chairman of the committee, stated that any work he had done on behalf of the committee was that referring to the first stage, and while a certain amount of work had been done on the physical side it was fairly familiar. His work as chairman consisted in collecting funds and paying bills, but he would be very glad to answer any questions.

A. G. Blackie, city chemist, Winnipeg. "In Dr. Thorvaldson's paper we have heard one of the best descriptions of the action of alkali ground waters on concrete that it has been my lot to listen to.

In 1908 I was instructed by the city engineer to investigate a sewer that had collapsed in Winnipeg. As a result of the investigation I reported that the collapse was due to the action of certain salts in solution in the ground water that came in contact with the sewer, and contrary to the usual belief, sewage or sewer gases had nothing to do with the collapse. I must say that that report was received with a good deal of scepticism, until I was able to establish by demonstrating in the laboratory that solutions containing sodium and magnesium sulphates destroyed concrete, but for a long time after that report was made, the few of us who were convinced that there was such a thing as alkali action on concrete had a hard row to hoe.

With regard to ground waters, Dr. Thorvaldson points out that in Alberta sodium is the prevalent sulphate, and in Manitoba magnesium is, whilst Saskatchewan falls between the two. (see Analysis of Water from the Prairie Provinces in Dr. Thorvaldson's paper.) I wonder if Dr. Thorvaldson can give any explanation for the gradual increase in magnesium as the ground water comes east, and also whether he thinks that the magnesium or sodium bearing waters do the greatest damage. In the laboratory I have found that by increasing test pieces, first in one sulphate solution and then in another, disintegration is brought about much more rapidly than when a single solution is used.

The failure of concrete exposed to sea water is a curious thing. There have been cases of very serious failures, but the instances in which concrete placed in sea water has withstood damage far outnumber the cases of failure. Why is this? Is it purely a case of the density of the concrete and the true proportioning of the aggregate, or is the cement itself responsible?

Dr. Thorvaldson has outlined the reactions that take place during the burning of Portland cement, when pure materials are used. You will have realized that the reactions are complex and the ultimate composition of the clinker depends upon the temperature that the burn is taken to. When the final temperature reaches something below 1,650 deg. C., the clinker has an approximate composition of 45% tricalcium silicate, 35% dicalcium silicate and 20% tricalcium aluminate.

Now, the ordinary limes and shales used in the manufacture of Portland cement are not pure materials, but contain quite a lot of impurities. Of these the most important is iron oxide. One of the effects of iron oxide will be to reduce the melting point of the clinker, and you can quite understand that different cement mills working in different parts of the country will have raw materials to deal with of very varying composition. Will not these variations cause considerable variation in the composition of the clinker, and is it not possible that the different mills will turn out cement with varying proportions of the two calcium silicates and aluminates? If this is so, may it not have a considerable bearing on why cement sometimes fails in sea water? I often wonder whether the modern cement mill with its high temperature rotary kiln is not to some extent responsible for our present day troubles.

You must remember that the ordinary methods of chemical analysis will not differentiate between or tell the proportion of dicalcium to tricalcium silicate, and of course for this purpose the standard methods of testing cement are also valueless. I wonder if Dr. Thorvaldson would care to tell us anything about the various treatment external and integral that are in the market, and are supposed by their makers at least to have solved the problem of alkali and waterproofing concrete. Personally, I have little faith in them, but I feel that both architects and engineers are often misled by the claims of the makers and vendors of such preparations."

Replying to Mr. Blackie's question, Dr. Thorvaldson mentioned the interesting fact that the waters in Alberta have a larger amount of sodium sulphate while waters in Manitoba predominate in magnesium sulphate. While there is a prevailing tendency for the Alberta waters to contain a large amount of sodium sulphate there are some there that contain a fair amount of magnesium sulphate. The difference in the composition of the Alberta and Manitoba waters might be accounted for by the fact that

in general the rivers run east in Alberta, Alberta being the highest point, and because magnesium sulphate is more soluble, especially at lower temperatures, than sodium sulphate. As to the variations in the compositions of cement due to the variation in the raw material he thought that it was the proportion of alumina and lime and silica present in the original material that counted, and, in general, not the combinations in which these were present in the raw materials. The temperature being so high during burning practically alters the chemical constitution of any rocks being used, so that the form the lime and silica and alumina are in does not make any difference. He realized that there might be exceptions to this but that the same kind of cement, under the same conditions of burning, would be formed, but the impurities certainly do make a difference, and therefore there might be a marked difference in cement with identical treatment, according to raw materials used, with the same proportion of lime and silica. He referred the question of water-proofing materials to Professor Williams.

Professor G. M. Williams, A.M.E.I.C., secretary of the committee, mentioned that his work was confined entirely to the first phase of the committee's programme, and that laboratory conditions could not reproduce those of the field, such as alternate wetting and drying. They had demonstrated that the action is dependent on the presence of sulphates in concentration. Generally speaking the results from waterproofing materials do not seem to indicate that they are going to be of any beneficial effect. There is a prolongation of life where there is a membrane of waterproofing which remains watertight. If the salt solution could be kept from the concrete there is no danger of disintegration.

Dr. Shipley, professor of chemistry, University of Manitoba, pointed out that immediate results could not be expected from Dr. Thorvaldson's work, comparing the situation with the study of disease, he thought that if the diagnosis of the complaint became known within one or two years, it would be making very rapid progress. In the meantime he thought considerable attention should be paid to protective means and when the disease was known to find some method of preserving the material or preventing reaction.

W. N. Smith, M.E.I.C., spoke of the alkali corrosion of gas pipes in the ground at San Diego, stating that the company had covered over a million feet of ordinary black steel gas pipe with a membrane of asbestos, felt and burlap, put on with hot asphalt, which had been very successful. He pointed out the importance of the question of the tremendous destruction of metal from corrosion every year and, being an economic waste, engineers should concentrate their attention on it.

Asked by A. A. Young, A.M.E.I.C., if it was safe to assume, once disintegration had started and the removal of the ground water had taken place, that action had ceased, even if moisture from rain is still in contact with the disintegrated concrete, Dr. Thorvaldson stated that if there is a large amount of disintegrated concrete in contact with the other, and that disintegrated concrete contains a large percentage of sodium sulphate, and magnesium sulphate it is not necessary to add any more salt, water alone causing the action to continue. In response to a question from Mr. McLean, asking if the work on hand meant a revolution of the cement industry, Professor Williams replied that that could only be answered when we get to the third stage. Only a very small amount of cement was affected, and it did not mean that the average engineer or most engineers would be affected by the work being done.

A hearty vote of thanks was tendered to Dr. Thorvaldson for his masterly paper and discussion.

Resolutions of Thanks

At the final session on motion by Councillor G. W. Craig, M.E.I.C., of Calgary, seconded by Councillor R. L. Dobbin, M.E.I.C., of Peterborough, the following resolutions of thanks were unanimously adopted: — To the City of Winnipeg, Mayor Fowler and Aldermen, for addresses of welcome and many courtesies extended, for the visit provided to the hydro-electric power plant at Point du Bois and for Civic Luncheon; to the Manitoba Power Company for the opportunity to visit Great Falls development and luncheon there; to the Association of Professional Engineers of the Province of Manitoba for entertainment at luncheon on Tuesday; to the Motor Country Club for courtesies extended and dinner provided; to the Southwood Golf Club for extending privileges; to the Old Colony Club for extending privileges; to the owners of Autos placed at the disposal of members; to the Fort Garry Hotel management for facilities provided; to the Members of the Manitoba Government and other distinguished men who have honoured us with their presence; to the Officers and Members of the Manitoba Branch for all they have done to make possible one of the most successful meetings yet held; to the authors of papers and all others who in any way contributed to the success of the meeting.

The Banquet

We're all here together,
We're all here together,
Tell the world we're here again,
We're the Engineering men.
Da-Da-Da-Da-Da-Da-Da.

This was the refrain that echoed again and again through the Banquet Hall during the final evening of the convention, while the other songs printed on the menu were not neglected, and college yells added further evidence that a joyous spirit was abroad. From the singing of "O Canada" to "God save the King" there was no lull in the interest and no cessation of enthusiasm. A visitor remarked, "What human fellows these engineers are. I never knew it before". Thus by constant progression, we are reaching the heights. The menu provided was of the best and the speakers all men of distinction and eloquence. Between speeches there were solos by the song leader, and much community singing. The function was a fitting conclusion to a most enjoyable and successful convention.

The chair was occupied by President Sullivan. The guests of the evening were the Hon. W. R. Clubb, Minister of Public Works of Manitoba; D. C. Coleman, vice-president of the Canadian Pacific Railway; Rev. Dr. Leslie Pidgeon, D.D.; and A. W. McLimont, vice-president and general manager of the Manitoba Power Company, all of whom made notable addresses, and about twenty other distinguished citizens and visitors including past-president Colonel J. S. Dennis, M.E.I.C.

Hon. W. R. Clubb said that Manitoba had not been making such rapid progress in road making as Ontario, possibly, but it had not been standing still. In the last few years practically five million dollars had been spent on good roads. Something like nine hundred miles of

roads had been gravelled, and there were almost three thousand miles of standard graded roads. In addition half a million dollars had been spent on bridges. Ontario was catering to the tourist traffic to a large extent by the construction of highways and certainly was getting that traffic. Manitoba was not doing that to any great extent at present, but if he could believe all the expressions of opinion it might have some inducement to offer inside the next eight months for a tourist trade. (Laughter). And if Manitoba was going to have a tourist trade, it must have good roads for the tourists to travel upon. He was not there to state the policy of the government, but a few words on what might be its policy might be in order. Possibly the scheme might not be so extensive as some citizens would like, but the government would link up all the missing links of highways in the province, and would institute a maintenance or government control system because there was no use spending money in the construction of good roads and then let them go to waste. If good roads were not maintained money had been wasted in constructing them and the expenditure was not justified.

Commenting on his trip with the delegates Wednesday, to Great Falls and Point du Bois, Mr. Clubb said the hydro development had been wonderful. He looked forward to greater things. He did not think the time was far distant when Manitoba would be able to say: "We do not have to take a back seat to Ontario in hydro development." The people who had invested money in hydro development had to be acknowledged as men of vision, and he hoped to live to see the day when electrical energy would be available to every home in this fair province.

D. C. Coleman, western vice-president of the Canadian Pacific Railway, said this company had employed many hundreds of engineers, and there was no body of men in the transportation field who had displayed more unselfish devotion and more genuine love of work than the engineers who made the Canadian Pacific railway possible and who had kept it abreast of the times in the matter of physical developnent. No one of wisdom or vision would accept the hopeless doctrine that democracy is a failure, but there was a noticeable and ever-increasing tendency to succumb to asphyxiating, high-sounding idealistic phrases. A phrase which should not be bandied about too much, said Mr. Coleman, was that of public ownership. This was not a question of principle at all, but a question of expediency. He maintained that without the stimulus of competition mankind would never have accomplished what it has. Competition between individuals, nations and races was responsible for the progress of the world. There was no sensible man who wanted to see more than absolutely necessary interference with private enterprise and the rights of the individual.

In an eloquent address, Rev. Dr. Pidgeon discussed education and its real object in bringing out all that was in a person and leading that person to devote his or her talents to the welfare of the community generally. Referring to Mr. Clubb's remarks about roads, Dr. Pidgeon caused a lot of laughter with the following statement: "My experience of Manitoba's roads is that they lend themselves more to dry than to wet conditions.

A. W. McLimont, general manager of the Winnipeg Electric Railway Company, spoke of the immense power possibilities of the plant which the Manitoba Power company is constructing at Great Falls, which will produce 170,000 horse power available for absorption. Mr. McLimont said that what Winnipeg needed was an abundance of cheap power, as that would bring in capital more industrial enterprise and more population.

"Hydro-electric power has built up Montreal, Niagara and many other places, and it will do the same thing for Winnipeg," said Mr. McLimont. "We believe that Winnipeg, with its additional hydro-electric power, will attract industries that will not only make this a great manufacturing district but the great metropolis of the Canadian northwest."

Notes of Winnipeg Meeting

Those not present missed a real treat.

Congratulations to the Winnipeg Branch executive and committees for they deserve great credit.

Hats off to the Winnipeg Branch. They are not only jolly good fellows but are great entertainers.

The blue automobile pennants were an innovation for an engineering gathering which could well be adopted for all future meetings.

The souvenirs distributed by the Manitoba Power Company, and the City of Winnipeg Hydro-Electric System will serve as lasting reminders of a day well spent.

President Sullivan, while advocating municipal ownership under certain conditions, made it clear that he was not committing the Institute to any such policy.

George Guy, the zealous one-hundred-per-cent-efficient, always-on-the-job, Branch secretary radiated good nature and enthusiasm and cheered the visitors with his joyous spirit.

J. G. Legrand, when the registration officers pinned the second badge of his lapel, remarked that such a display of colour and gilt and tinsel reminded him of a St. Jean Baptiste parade.

The engineers of Manitoba are doing much to place the engineering profession on a higher pedestal of public recognition, the result of which was particularly notice able to those from outside points.

The large electric sign in front of the city hall, "Welcome Engineering Institute", was an external evidence of the city's greeting, while the civic officials in person gave evidence of a hearty welcome during the entire convention.

Telegrams of regret were received from Vice-President Walter J. Francis, Vice-President H. G. Acres and Councillor A. C. D. Blanchard, expressing regret at their inability to be present and extending greetings to their fellow engineers.

The committee investigating the deterioration of concrete in alkali soils held a full day's session on Monday, September 4th, at which a report was received from Doctor Thorvaldson, in charge of the investigation, and plans for future activity were discussed. An excursion was made to the field operations being carried on by the Winnipeg section of the committee.

Once more again —

We're all here together,
We're all here together.
Tell the world we're here again,
We're the engineering men.
Da-Da-Da-Da-Da-Da-Da.

General Professional Meeting

Winnipeg, Man., September 5th, 6th, and 7th, 1922.

Registration

Name	Address
J. G. Sullivan	Winnipeg
Fraser S. Keith	Montreal
E. P. Fetherstonhaugh	Winnipeg
J. A. Douglas	Winnipeg
J. G. Legrand	Winnipeg
Geo. W. Craig	Calgary
T. L. Roberts	Winnipeg
C. W. U. Chivers	Winnipeg
G. D. Archibald	Saskatoon
A. L. Cavanagh	Winnipeg
R. A. Carlyle	Winnipeg
C. A. Battershill	Winnipeg
B. Russell	Calgary
F. de C. Davies	Winnipeg
J. Lonsdale Doupe	Winnipeg
G. H. Cagnat	Winnipeg
W. D. Pender	Winnipeg
E. F. Chandler	Grand Forks
Douglas L. McLean	Winnipeg
J. Lee	Winnipeg
F. T. Hartle	Winnipeg
A. S. Dawson	Calgary
P. Burke Gaffney	Winnipeg
K. M. Winslow	Winnipeg
R. L. Dobbin	Peterboro
A. J. Sutherland	Winnipeg
E. H. Morse	Winnipeg
R. H. Cooper	Winnipeg
Chas. W. Dill	Regina
E. V. Caton	Winnipeg
C. A. Clendening	Winnipeg
C. H. Atwood	Winnipeg
J. Rocchetti	Winnipeg
Newton Wallis	Winnipeg
H. G. Mitchell	West Kildonan
R. A. Hazlewood	The Pas
L. B. Copeland	Winnipeg
V. Michie	Boissevain
G. R. Pratt	Winnipeg
N. M. Hall	Winnipeg
L. I. Johnstone	Winnipeg
C. F. Cameron	Winnipeg
C. S. Walley	Winnipeg
E. McAuley	Winnipeg
John Young	Winnipeg
W. E. Lovell	Winnipeg
J. P. Howard	Winnipeg
J. M. Allen	Winnipeg
B. Bider	Winnipeg
James Milne	Toronto
J. A. Kelso	Edmonton
James Veitch	Winnipeg
H. Stainton	Winnipeg
W. W. Dines	Winnipeg
F. B. Hazel	Winnipeg
C. A. Millican	Winnipeg
J. C. Irving	Deloraine, Man.
W. Youngman	Winnipeg
Thomas T. Wilson	Dauphin, Man.
Thos. C. Main	Winnipeg
D. G. Sutherland	Selkirk
L. G. VanTuyl	Winnipeg
J. H. Meindl	St. Boniface
Thomas H. Wilson	Norwood
J. M. Leamy	Winnipeg
E. A. Childerhose	Winnipeg
Ralph C. Pybus	Winnipeg
H. S. Van Scoyoc	Montreal
B. E. Norrish	Montreal
Terry Ramsaye	New York City
G. Wilkins	Winnipeg
J. W. Battershill	West Kildonan
W. N. Smith	Winnipeg
C. W. Noyes	St. James
A. V. Redmond	Winnipeg
G. M. Lang	Winnipeg
D. A. MacDougall	Winnipeg
J. G. Glassco	Winnipeg

Name	Address
C. P. Morse	Winnipeg
J. M. Whiteside	Winnipeg
H. S. Rimmington	Winnipeg
R. W. Moffatt	Winnipeg
S. B. Wass	Fort William
S. F. Ricketts	Winnipeg
G. L. Shanks	Winnipeg
J. C. D. Taylor	Winnipeg
A. R. Greig	Saskatoon
R. V. Slavin	Winnipeg
S. Vineberg	Winnipeg
J. C. Munro	Winnipeg
H. Sprenger	Winnipeg
T. W. Clarke	Winnipeg
W. A. Robinson	Winnipeg
J. R. C. Macredie	Moose Jaw
W. C. Taylor	
A. V. Polson	Winnipeg
C. J. Oliver	Montreal
T. Thorvaldson	Saskatoon
C. J. Mackenzie	Saskatoon
R. W. McKinnon	Winnipeg
J. S. Abel	Winnipeg
J. M. Fleming	Winnipeg
Chas. F. Barnes	Winnipeg
C. R. Lys	Winnipeg
Charles F. Gray	Winnipeg
Gerald S. Roxburgh	Winnipeg
Ron. Wallace	Winnipeg
Lawrence E. C. Frith	Winnipeg
F. H. P. Parr	Winnipeg
H. A. Dixon	Winnipeg
D. M. Bright	Winnipeg
Thos. H. Kirby	Winnipeg
Cecil H. Gunn	Winnipeg
M. T. Cantell	Winnipeg
E. J. Buckingham	Winnipeg
David Smith	Dauphin
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F. H. Martin	Winnipeg
G. E. Bell	Montreal
B. W. Parker	Winnipeg
S. W. Campbell	Winnipeg
W. J. Wilson	St. Boniface
V. J. Melsted	Winnipeg
E. C. Cowan	Oakbank
H. A. Brazier	London, Ont.
F. X. Amos	Winnipeg
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J. E. St. Laurent	Winnipeg
J. W. Porter	Winnipeg
L. I. Easton	Winnipeg
K. MacKenzie	Winnipeg
D. E. Berg	St. Boniface
E. M. M. Hill	Winnipeg
W. A. Lewis	Winnipeg
R. J. McKenzie	Broomhill, Man.
W. M. Scott	Winnipeg
Geo. W. Goodall	Winnipeg
A. A. Young	Winnipeg
D. A. Ross	Winnipeg
H. Edwards	Winnipeg
H. M. White	Winnipeg
F. A. MacLean	Winnipeg
Garnet Affleck	Winnipeg
John Gordon	Winnipeg
R. W. Jickling	Winnipeg
L. F. Brimer	Winnipeg
F. G. Earle	Brandon
H. A. Morton	Winnipeg
R. H. Andrews	Winnipeg
J. H. Smythe	Winnipeg
N. B. MacTaggart	Winnipeg
A. W. Lamont	Winnipeg
E. S. Kent	Winnipeg
W. P. Brereton	Winnipeg
V. C. Moynes	Winnipeg
T. Deacon	Winnipeg

Name	Address
Eric W. M. James	Winnipeg
L. R. Brereton	Winnipeg
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E. H. Chapman	
B. A. Johnston	Winnipeg
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B. S. McKenzie	Winnipeg
A. Trott	
A. McGillivray	Winnipeg
A. H. Corbett	Winnipeg
Geo. J. Brown	Winnipeg
H. W. McLeod	Winnipeg
J. W. Harris	Winnipeg
J. A. Hesketh	Winnipeg
E. N. Johnson	Winnipeg
Alexander D. Ferguson	Elm Creek, Man.
G. G. Yates	
Hugh D. H. Scott	Winnipeg
F. H. Boyd	Winnipeg
J. M. Campbell	Winnipeg
John Woodman	Winnipeg
Philip Baker	Winnipeg
Sydney E. Junkins	Winnipeg
R. H. Montgomery	Ottawa
Geo. A. Walkem	Vancouver
Fred. Newell	Montreal
John Craig	Winnipeg
W. Walkden	Winnipeg
R. C. Robinson	Dauphin
G. E. Collinson	Winnipeg
Frank P. Jones	St. Boniface
C. H. Blanchard	Winnipeg
John F. Wilson	Winnipeg
H. Lloyd	Winnipeg
Wm. Davis	Winnipeg
J. Quail	Winnipeg
George F. Porter	Walkerville, Ont.
J. N. Finlayson	Winnipeg
J. C. Holden	Winnipeg
Wm. F. Tempest	Winnipeg
G. Mossman	Pointe Du Bois,
J. M. Davidson	Winnipeg
F. A. Cambridge	Winnipeg
J. C. Davis	Winnipeg
R. J. Crosbie	Winnipeg
J. H. Edgar	Winnipeg
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C. S. Landon	Winnipeg
R. E. Weeks	Winnipeg
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Grant P. Pearson	Winnipeg
H. A. K. Drury	Winnipeg
Nelson Barnes	Winnipeg
Wm. Fulton	Winnipeg
J. D. Ruttan	Winnipeg
A. S. Weekes	Winnipeg
J. L. Rannie	Ottawa
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The Mechanical Working of Iron and Steel

An outline of Modern Rolling Mill Practice, describing the Processes in various types of Mills

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Paper read before the Cape Breton Branch, The Engineering Institute of Canada, May 4th, 1922.

The mechanical working of steel improves its quality by closing up cavities and by refining its crystalline structure and so has important functions apart from the mere reductions to form and size. In mechanical treatment a distinction has to be made between "cold working" and "hot working" of steel. Steel which is worked below the critical temperature is termed "cold worked steel", and when worked at a temperature above the critical point is termed "hot worked steel". (The critical temperature of steel is that point at which the carbon content dissolves to form a homogeneous mixture. It varies inversely as the carbon centent and is usually between 1,200, and 1,600, degrees F.)

Cold working causes permanent distortion, or strain, of the structure of the metal and the properties of the metal are deeply affected. The elastic limit, tensile strength and hardness are increased, while the ductility is reduced.

Hot working tends to mechanical refinement and, owing to the plasticity of the metal at the higher temperatures, the distortion due to working into shape does not produce permanent strain in the structure of the steel.

Three Methods of Mechanically Working Hot Steel

There are three practical methods of applying pressure to steel during mechanical working, viz; hammering, pressing, and rolling. Shaping steel by hammering and pressing is called forging.

Hammering was the first method employed by man in shaping the metals, and the first forging was done by hand hammers wielded by workmen. As far back as the middle ages, when some of the finest examples of the blacksmith's art were made, as shown on the many old cathedrals in Europe, a tilt hammer was in use, which consisted of a beam of wood heavily weighted as the striking end. Early in the last century the steam hammer was developed. The principle of hammering is that of an instantaneous application of pressure applied to a relatively small area. The strains set up are compressive and take place in a vertical direction in the region below the area subjected to the force of the blow.

The Forging Press

The forging press is an English invention dating from the year 1861. It consists essentially of a hydraulic cylinder supported by one or two pairs of steel columns which are anchored to a single base casting of great weight and strength. The pressure is applied slowly and is gradually increased to a maximum which may be maintained until the metal yields.

In practice it is found that the lowest pressure that can be employed, to be effective at a full forging heat, is about 1.25 tons per square inch, but the pressure employed in actual work will often reach 13.25 tons per square inch. Unlike the instantaneous application of pressure, as in the case of the hammer, the action of the press is so slow that a kneading of the metal takes place and the strain instead of being confined to the surface, penetrates deep into the steel.

The Rolling of Steel

The commanding importance of the iron and steel industry, is due to the strong ascendency of rolling mill practice. Beams and rails can no longer be produced in sufficient quantity and quality by forging. Of all the known methods of shaping iron and steel from the cast material, that of rolling has come to be the most extensively used, although not producing the best quality in certain classes of product.

An Englishman, named Henry Cort, developed this method of working iron as long ago as 1785, having previously, in 1784 invented the process known as "puddling", the importance of which has been considerably diminished since the invention of steel. He also invented the rolling mill by which the puddled bars of iron were rolled into bars.

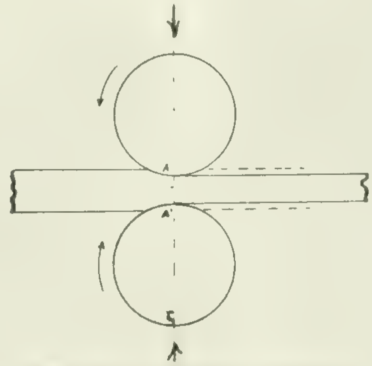


Figure No.1. Principle of Rolling.

The priciple of rolling is illustrated by figure No. 1. The two circles represent two plain motionless rolls which are being forced into the hot bar by means of pressure applied vertically. Vertical compression of the metal will occur at the points A and A', and a certain amount of metal will flow at the point of contact of the rolls and the bar will be elongated a little. If now the rolls are made to resolve in opposite directions, a second force is introduced, the result of which is to subject the bar to a longitudinal pull. The net result of this double action is to cause the metal to flow forward, reduced in size, and at a higher velocity than the steel entering the rolls or the peripheral speed of the rolls.

One of the most essential parts of a rolling mill are the rolls. These are carried in suitable housings, and so arranged that they can resolve, being positively connected

to the source of power, either the steam engine or the electric motor.

There are three parts to a roll; the body, the necks, the wobblers. The body is the cylinder part, plain or grooved, to suit the different kinds of work as may be required. The necks are the journals on which the roll revolves, they are carried in the chucks or bearings. The wobblers are the fluted ends of the roll which engage the coupling boxes, which are connected to the main drive.

Working of Iron in Rolling Mills

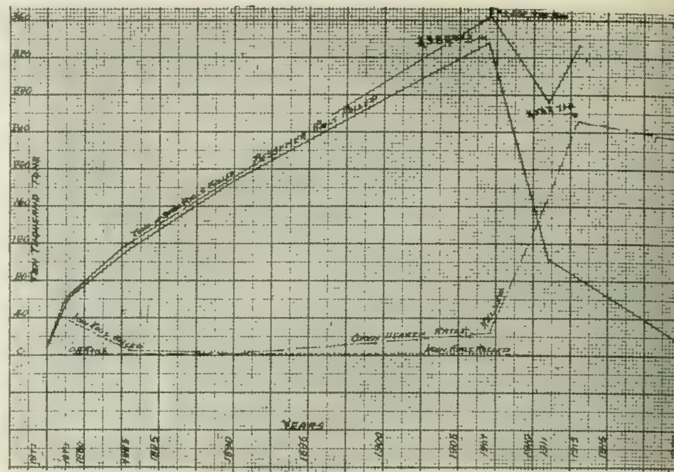
Since it was the working of iron that developed the rolling mill a short description of how this was done will be given.

Before steel making was discovered, iron was made in what was called puddling and bussling furnaces, in which a mixture of pig iron and scrap is worked in a suitable flame until a lump, (called a ball), of sponge iron is developed. This was hammered or squeezed out into the shape of a small slab, (called a shingle) and after again heating it is hammered or put through a pair of rolls running in opposite directions and made into a plate about three-quarters of an inch thick and six inches wide. These plates are used to make piles, that is, sandwiched between two of these plates is placed a quantity of miscellaneous scrap, such as nails, spikes, wire, etc., and the whole is tightened under a screw press and bound with hot wire. The pile is heated in the mill furnace and rolled into iron bars, sections, etc.

There are many plants still making puddled iron and scrap piles, rolling the same into iron bars, iron rods, chain bars, etc. They have a good market for their products owing to the fact that these have a greater resistance to rust and oxidation than steel bars, and on this account often command a better price.

Until 1877 more iron than steel rails were rolled, while in 1879 the production was:—steel rails 618,850 gross tons, iron rails 375,143 gross tons, and in 1883 steel rails 1,156,911 gross tons, iron rails 57,994 gross tons. From this date the production of steel rails shows a steady annual increase until 1907, when it was 3,632,729 gross tons. On the other hand the production of iron rails declined as follows:—in 1890 production was 13,882 gross tons, in 1907 production was 925 gross tons, and in 1911 iron rails ended with a production of 234 gross tons.

The accompanying curves show the production of iron and steel rails at different periods, illustrating how steel has supplanted iron, and also a comparison of the production of Bessemer and open hearth steel rails and iron rails. The production of Bessemer steel rails increased until 1907, when there were 3,380,025 tons rolled, and open hearth steel rails started climbing until open hearth tonnage passed the Bessemer tonnage in 1911. In 1913 open hearth tonnage reached its highest point when there were 2,527,710 tons rolled, and Bessemer 817,591 tons, while in 1920 Bessemer tonnage declined to 142,899 tons when 2,334,222 tons of open hearth rails were produced. A considerable part of the Bessemer tonnage now rolled is light rails.



Curves Showing Production of Iron and Steel Rails at Various Periods

Heating

Before steel can be worked hot it has to be heat treated in suitable furnaces, the design of which is a subject in itself.

The steel, in molten state, is poured into moulds of a uniform shape and size, convenient for working, to make ingots. These ingots are delivered to the rolling mills as soon as possible after pouring. Before they can be rolled the ingots must have been allowed to solidify throughout, and the whole mass should be of a uniform temperature. To get this result the ingots are charged in soaking pit furnaces, if possible, before the ingots have completely solidified. In cooling naturally these conditions are not fulfilled, because the outside of the ingot is the first to solidify, being the part from which the heat is removed most rapidly.

This fact was early recognized in rolling mill practice and it was originally the practice to strip the semi-molten ingots as soon as possible and place them in holes in the ground lined with refractory brick, where the heat from the centre was conveyed to the outside by conduction and the brickwork of the pit was also heated. This process was called "soaking", hence the name soaking pit.

In order to bring the soaking under better control and to make it adaptable to varying conditions, means for supplying additional heat were introduced so that the soaking pit developed into a combined soaking and heating furnace, hence the term soaking pit furnace. A very common type of soaking pit furnace is the four hole regenerative reversing furnace, capable of holding four ingots in each pit or sixteen ingots to the row, which is under the one control for gas and air, or under individual control as may be required by the heater. The ingots are charged into the pits in an upright position, the centre portion of the ingot in many cases being still molten they must stand in an upright position until this portion has become solid. The best practice demands they must be charged as hot as possible, so that they will reach the rolling condition with as little fuel for reheating as possible. Great injury can be done to steel during the heating process. It can be underheated, overheated, unevenly heated or worse than all, burned.

Different conditions of manufacture, and different grades of steel require different treatment in respect to temperature. The usual practice when three-ton ingots are charged soon after pouring, is to give them a reducing flame, (a jet of gas with hardly any air), until, the ingots begin to reach the stage known as "sweating". From personal experience this usually takes the same length of time as from pouring to charging in soaking pits, usually around thirty-five minutes. The gas and air is then shut off, the dampers closed, and the steel allowed to soak for about twenty-five minutes. Sufficient gas and air is then put on to bring the outside of the ingot to rolling temperature which is usually about 2,200 degrees F., for low carbon steel. The required time in the soaking pit furnaces is around one and one-half hours.

Mechanical Working

The ingot is the starting point for all mechanical working, and it will be interesting to mention the various processes that steel undergoes to produce the many articles for which it is used. Ingots after heating are made into:—large forgings; armour plate; sheared and universal plates; shaped blooms for large sections; slabs, which after reheating are rolled into sheared and universal plates; blooms, which are directly rolled into billets, which after being reheated are rolled into rods, bars, bands, hoops and small shapes; rectangular blooms, which are cut into required lengths and reheated to make rails, rail joints, structural shapes, sheet bars, skelp, from which on again being reheated are made tubes and pipes; forgings; cylindrical blooms, which after reheating are made into wheels, circular shapes and shell blanks.

The classification of mills, which comprise nearly all the rolling processes, is diagramatically shown by figure No. 2. There you will notice roughing mills which roll material direct from the ingot:—namely, blooming or cogging mills and slabbing mills rolling semi-finished products; then we have plate mills rolling a finished product.. Under the heading of finishing mills there are:—shape mills, rail mills, wheel mills, merchant mills, wire rod mills, pipe mills and sheet mills rolling from blooms, billets, sheet bars and slabs, making the following finished products:—beams, channels, angles, zees, tees, splice bars, rails, car wheels, gear blanks, bars, bands, hoops, cotton ties, small sections, wire rods and wire mills products, seamless tubing, black sheets, eye bar flats, universal mill plates, sheared plates, skelp, which is used for making welded pipe.

As a preliminary step to the forming of steel into the various sections which its many uses require, the heavy ingots are first roughly reduced to much smaller size of simple section, except in the cases of plates and heavy structural shapes. This preliminary work is done in a blooming mill, (called a cogging mill in Europe), owing to the type of drive used in the earlier mills. There are various types of this mill in use, but the common practice is to use either a "two high reversing" or a "three high continuous". Blooming mills, owing to the necessity of heavy and rough work, are the largest and strongest used to roll steel. Most mills of recent construction have rolls of 40 inches in diameter.

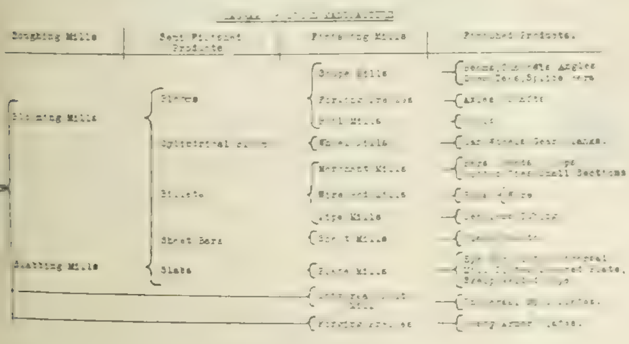


Figure No. 2.

In the two high reversing mill, the top roll is turned slightly larger in diameter so that the bar will always tend to turn down towards the table. In the reversing type of blooming mill the two rolls revolve in opposite directions. The large pass, being the first one the ingot of steel is delivered to, is made the same width as the small side of the ingot, and collars are provided to guide the ingot.

The ingot is drawn from the soaking pit with the aid of a special type of crane and delivered to the rolls delivery table, and the operator brings it to the rolls and with the aid of a manipulator, he can place it opposite any desired pass. (In passing it may be mentioned that most rolling mills have tables made up of revolving rollers, these can be operated in either direction at the will of the operator.) He moves the ingot and adjusts his rolls to give it the following work.

In the first pass with heavy drafts he reduces it until it is small enough to enter between the collars of the next smaller pass. He gives it a quarter turn and breaks it down in the second pass until it is of suitable size to be edged into the third pass, making the ingot smaller and smaller in cross section, until the desired size is reached. All passes except the last or finishing pass are usually given a swell on the roll, this helps to work the corners better and prevent corner troubles. A fillet at the base of the collars keeps the corners rounded and prevents them cracking. All passes are roughened or knurled to enable them to bite; the smaller passes being ragged a little deeper.

Each time the ingot passes through the rolls it is elongated and the bar gets longer and longer until a three-ton ingot will be about thirty-one feet in length when rolled down to an 8″ x 8″ bloom. This bloom is run down to the shears on the tables and cut into the desired lengths. An average life of these rolls is about 80,000 tons of rolled blooms.

Rail Mill

The working down of a hot bloom into rails will be given for the description of a heavy section mill as this is typical of many similar sections and probably of more local interest, owing to rails being a very important product of the Sydney plant.

The bloom which was described as rolled down to an 8″ x 8″ section in the blooming mill is transferred to the rail mill where it is charged into a reheating furnace for heat treatment. This furnace is of a continuous type, which means that the hot steel enters at one end and is delivered at the other. The temperature of the bloom on entering the furnace is about 1,900 degrees F., and when delivered is raised to 2,200 degrees F., and at

a soaking heat. It is then sent to the rail rolls where it is smashed down as shown in figure No. 3.

The bar only gets one pass in the finishing rolls, which are specially made of chilled iron so that they will give longer wear and hence more tonnage. The finished section has to be maintained reasonably smooth and very accurate in size. When the rolls wear this condition cannot be maintained and they have to be taken out and sent to the roll shop where they are dressed and made to template size again. Two thousand tons is considered very good tonnage after each dressing.

After leaving the finishing pass, the rail is delivered to the hot saw where it is cut into the standard lengths. The hot saw is a circular coarse tooth saw, 42 inches in diameter and running at a speed of over 1,500 r.p.m., and must cut all the rails square all the time. The rail is hot-straightened on its way to the colling beds, which are levelled so that when the rail is cold it is reasonably straight. When the rails are cold they are sent to the finishing mill where they are chipped, cold-straightened, and drilled for the bolt holes. The inspection is very rigid. They are all individually examined on all sides, tested for length and squareness of the ends, and then shipped on cars to the customer.

The rolling of steel into shapes and bars and the designing of the roll passes requires a considerable amount of skill and experience. Constant attention is required when rolling steel to avoid overfills, underfills, fins, laps, guide marks, pickups, or any other rolling defects.

Fins are caused by a section being too large for the pass it is entering, causing the metal to flow out bteween the collars. These fins will fall over and cause laps in the following pass. Guides and guards are used in order to prevent collaring and to insure that the piece enters and leaves its pass in the correct position. Guards are devices employed mainly on the delivery side of the mill to control the direction of the piece after leaving the pass.

The Rolling of Steel in Continuous Mills

To illustrate the rolling of steel in continuous mills, the case of making 1¾-inch square billets, 30 feet long, direct from the ingot at one heat, will be taken. To make 1¾-inch billets direct, the ingot is rolled down in the blooming mill to a 5″ x 5″, the top part is cropped off at the shears, and at the same heat the bloom is delivered into the continuous billet mill rolls.

The billet mill at the local plant is a 16-inch Morgan mill, this consists of six stands of rolls running at variable speeds, driven by a train of gears connected to an engine. The principal of this type of mill is that the 5″ x 5″ square section bloom is edged up diagonally, and entered into the first set of rolls, which have a diamond pass. The cross section is now reduced to a diamond, and travelling on is twisted with the aid of guides enough to give it a quarter turn by the time it reaches the second pass, where it is smashed down to a smaller square. The speed of each successive set of rolls is made faster, so that the reduced section travelling at a higher velocity will clear the same volume of metal that the first set of rolls is delivering. This will be explained by reference to figure No. 4.

Each of the circles represents a revolving roll, which in practice is made to revolve slightly faster than actually required, so as to impart a certain amount of tension between the different sets of rolls. This is a continuous application of the principle shown in figure No. 1, illustrating the principal of rolling.

The same process is carried on with No. 3 and No. 4 sets of rolls, No. 3 pass being a smaller diamond, this is twisted up so that it is edged in No. 4 and a still smaller square is delivered. The square bar coming from No. 4, being again reduced, enters No. 5 diamond and is delivered and twisted up on edge to enter No. 6 finishing pass, which is a square pass, making the bar 1¾ inch square. This is cut up into suitable lengths while still travelling, with the aid of a flying shears. The ingot is then in the six sets of rolls and the shears simultaneously. Entering the first set it is twenty-five square inches of cross section and on being delivered on the colling beds at only three square inches of section, a reduction of 88 per cent.

The velocity of steel delivered from each pass in feet per minute is as follows: No. 1 pass 91; No. 2 pass 114; No. 3 pass 177; No. 4 pass 221; No. 5 pass 344; No. 6 pass 427.

Wire Rod Mill

The application of continuous rolling is used with very good effect in rolling No. 5 gauge wire rods, which are the basic product of the wire mills. Wire rods are rolled direct from 1¾-inch square billets. There are reheated in a special continuous furnace made wide enough to take 30-foot lengths.

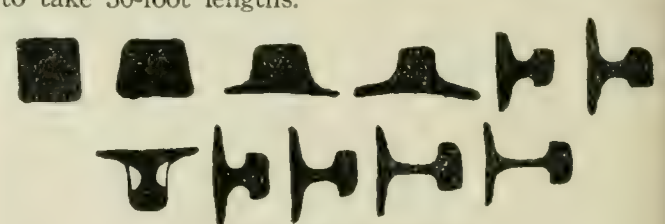


Figure No.3. Rolling Rails.

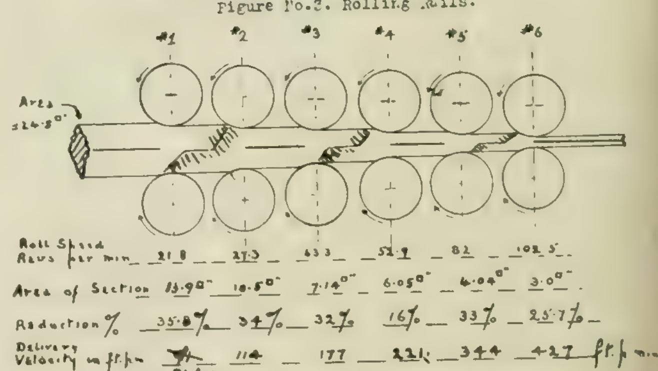


Figure No.4. Principle of Continuous Rolling.

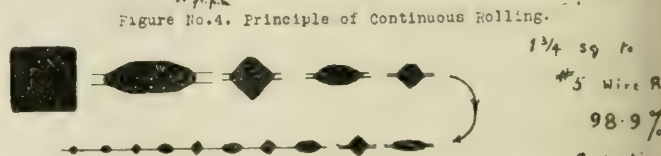


Figure No.5. Passes of Continuous Rod Mill.

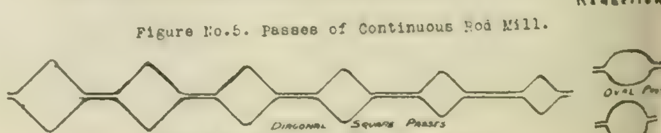


Figure No.6. Passes of Merchant Mill.

In the Morgan rod mill there are fourteen stands of rolls. The billets are fed into this train direct from the furnace. The principle is the same as with the working of the continuous billet mill already explained. The 1¾-inch billet is smashed down in a series of ovals and squares until the last pass where it is made into the small finished round, the bar being twisted up in alternate stands to give the oval a quarter turn before entering the following square. The rod is delivered from the finishing pass at a very high velocity, and is reeled into bundles ready for the wire mill. The velocity of the rod when leaving the finishing pass in the local mill is 2,678 feet per minute, and in the later type of mills is much greater. In the Morgan mill two strands of rod are rolled through the mill at the same time. Chas. H. Morgan of Worcester, Mass., developed this type of mill to its present perfection. He elimated the vertical rolls of the earlier mills, by twisting the hot bar in special guides, to give it the necessary quarter turn to edge the oval.

The passes of the continuous rod mill in diagramatic form are shown in figure No. 5.

Merchant Mill

As typical of merchant mill practice the case of rolling some 1½-inch guide round bars which are required in 16-foot lengths, will be taken. The first thing to consider is the size and weight of the billets required to roll them from. There are several considerations to take into account when ordering these. Allowance must be made for loss of scale in furnace and rolls, usually about two per cent, and the weight must be arranged to suit the length of bar leaving the finishing pass so as to give multiples of the required length with very little discard. In this case it would take 49 feet which includes one foot for crops at 6 pounds per foot which means 294 pounds. To this weight allow 6 pounds for scale loss, this brings the weight of billet to be ordered up to 300 pounds.

The size of the billet is governed by the size of the first pass in the roughing or breaking down rolls, say 5″ x 4″, and these are ordered from the blooming mill where they are rolled as previously illustrated and cut into 300 pound lengths.

The billets are reheated in the merchant mill furnace and rolled down in the roughing stand as follows: The first passes are usually of the box type and the 5″ x 4″ is smashed down to a 4″ x 4″ in the first pass; to 3″ x 4″ in the second pass; and to 3″ x 3″ in the third pass.

It is then taken to a second stand of strand rolls which are usually a series of diagonal squares, smaller and smaller, as shown in figure No. 6. The bar is given a quarter turn at each pass so that all the corners will get worked on. It is then taken to the stand with the leader pass or oval. This pass is made of exact size and shape, which is determined by experience, so that the bar delivered from this free from overfills or laps will exactly fill the finishing pass which of course is a perfect round 1½-inch in diameter. The same rolls are often laid out so as to make it possible to roll many similar sizes without changing rolls.

In rolling small shapes on the merchant mill a similar procedure has to be gone through and the hot billet would probably be worked down as shown in figure No. 7.

Sheet Bar

In rolling blooms, billets and small slabs the piece is held to dimension not only by the shape of the groove but also by edging the piece in certain of the passes. In rolling sheet bar the thinness of the piece will not permit edging after it leaves the roughers. A form of closed box pass called the tongue and groove pass is used. A groove corresponding to the width of the piece desired is cut into one of the rolls, while a tongue cut in the opposite roll fits into the groove, the sides of the latter being cut at a slight angle to the bottom. The tongue closes the pass on the remaining side.

Owing to the heavy drafts taken, the metal is squeezed up into the clearance between the tongue and the edges of the groove thus forming a fin on each side of the pass unless precautions are taken to prevent it. These fins are prevented from forming by making fillets in the groove and so arranged that the rounded edges formed by the fillets enter the succeeding pass opposite the openings formed by the clearance between the rolls. In this way a fin is avoided because the spreading of the metal merely fills out the round corner of the bar leaving no excess metal to be squeezed up between the rolls. The bar is finished in plain rolls which are always chilled iron rolls.

Figure No. 8 illustrates the manner in which the bloom is usually worked down. Owing to different conditions of temperature of the bar going through the finishing rolls, it is sometimes necessary to have a man stationed at these rolls to adjust the screw up and down, to suit the temperature of the bar in order to keep the thickness uniform. Sheet bar is all approximately eight inches wide and varies in thickness to give weights from seven to forty-three pounds per lineal foot. In exceptional cases it is made in twelve and fourteen-inch widths, for heavier sheets. After a mill is once set for rolling sheet bar the different weights of bar are obtained by adjusting the rolls heavier or lighter as the case may be. Steam jets and water sprays must be used on both surfaces

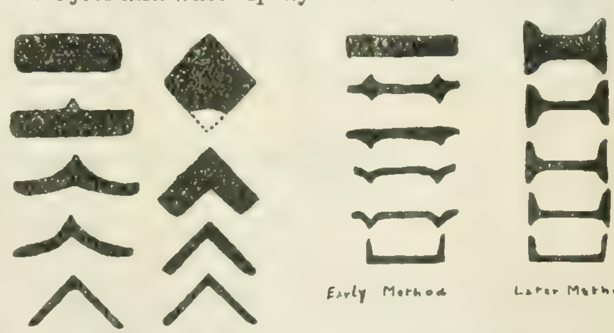


Figure No.7. Rolling Angles and Channels on Merchant Mill

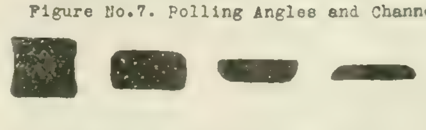


Figure No.8. Rolling Sheet Bar.

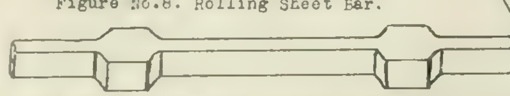


Figure No.10. Irregular Bar Witherow Steel Co.


Figure No.9. Irregular Sections

of the bar at every pass, it being absolutely necessary to produce a smooth surface on sheet bar. When sheet bar is rolled on continuous mills, vertical edging rolls are used in place of the tongue and groove pass. The vertical edging rolls control the width.

Rolling of Deformed or Irregularly Shaped Sections

A typical section of this kind is a deformed tie plate as shown in figure No. 9. The arrow shows the normal direction of rolling, but it could also be rolled in the other direction at right angles to the arrow. This tie plate would probably be rolled from an 8″ x 8″ bloom. It would be rolled down in eight or ten passes to a rectangular section with a thickness of approximately equal to that of the ultimate section over the lugs, the final form being obtained entirely in the last pass. This means that in the last pass certain parts of the bar are given very large reductions and the other parts are reduced very little. This condition requires a considerable flow of metal in some of its sections, if the section is to be kept uniform. The operation is in reality one of die forming, and a low speed is required to get this effect.

The Witherow Steel Company, Pittsburg, now make deformed bars, tie rods, automobile axles and shafts, in their rolling mills. The process has been termed continuous die forming. The rolls are in segments which, when assembled upon a mandrel, form segmental rings. A simple type of a bar which they roll is shown in figure No. 10. The bosses on this flat bar are spaced in equal distance around the pass of the roll. The wear of the pass is dressed up by taking out the ring segments. Automobile axles are now rolled this way, the circumference of the roll varying to suit the different die forming sections.

Re-rolling Rails

Used rails from the railroads and mill seconds are the raw material for this work. These are heated in continuous furnaces and then handled in two ways: (1) They are rolled down to smaller sections to supply the demand for pit rails; (2) They are split into three parts, head, web and flange, by passing through a set of splitting rolls and these three parts are then separately rolled into angles, concrete bars, splice plates, steel ties, fence posts, etc. There are eighteen re-rolling mills in the United States and at the Sweet's Steel Company, Williamsport, Pa., they use seven passes for working a 135-pound rail down to a 35-pound, or 125-pound rail down to a 30-pound, or 100-pound rail down to a 25- or 20-pound, or 85-pound rail down to a 16-pound. These involve reductions of seventeen to twenty-one and one-quarter per cent per pass. Two additional passes are required in working 100-pound rail to 12- or 16-pound with reductions of twenty-one and eighteen and one-half per cent per pass.

The splitting rolls have cutter collars and have five passes to accommodate the different size rails that may have to be split. The cutter collars function for months without redressing.

Working of Iron in Rolling Mills

A new mill recently put down in Belgium for making and rolling iron contains seven puddling furnaces working a mixture of pig iron and scrap. The sponge is carried to the steam hammer where it is shingled and at the same heat is rolled in the forge train into a 6½″ x ½″ bar. Piles are made of the faggoted box type with miscellaneous scrap, rods and crop ends piled between the two plates and pressed together and bound with hot wire.

The mill furnaces are made of the combination type, that is, gas producer and furnace combined. The mill consists of two trains of rolls; the first train, directly driven from the engine, is a 16-inch three high stand of breaking down rolls, running at 80 r.p.m., while the second train consists of six 10-inch three high stands driven with a rope drive from the flywheel of the engine at 240 r.p.m.

Twenty passes are required to roll the 6½-inch piles down to ⅝-inch rounds: nine passes in the breaking down rolls; three in the roughing rolls; four in the second stand; two in the third stand; one in the oval, and one in the finishing rolls.

Finished bars, about 100 feet long, are delivered at about ten feet per second, and the average output is about twenty-eight tons per eight-hour shift.

Considerations for a Road Policy

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Paper read before the General Professional Meeting, Winnipeg, Man., September 7th, 1922.

The roads and highways of any county hold a very unique position. They are entirely devoted to, and can be considered only from, the view point of "service". There is no other reason why there should be roads except to serve the public. Railways serve the public but up to the present they have not been constructed to serve unless there is a hope that they will at least pay their way. Street railways, power systems, telephone systems, water-works and other public utilities are expected to be paid for directly by those who enjoy these utilities; but roads are to be paid for by the public at large and seldom if ever by the people who use them in proportion to services received. In considering a road policy we must always keep before us that the whole aim of our policy must be one which will give the greatest value in *service*. This *service* is not for any one group of people, — not for the farmer alone or for the manufacturer; not fo the man with a team or the man with the automobile not for the worker alone or the pleasure seeker; bu *service* to all who wish to use the road.

Importance of the Road Question

Before giving consideration to some underlying prin ciples in selecting a road policy it may be well to brin out some facts which will emphasize the importance of th road question, and in so doing it will be compared wit that utility with which it can best be compared, th railway. Looking up the railway statistics for the yea 1919, we see that in that year the railways carrie 111,487,780 tons of freight, which cost the owners 27 million dollars in freight charges. The Dominion Commi sioner of Highways has estimated that about fifty per cent c

this freight was at one time or another hauled over rural roads, and an analysis of the type of freight which made up this tonnage would bear out this estimate. It must also be kept in mind that there is a large amount of material moved over rural roads which does not reach the railways. It would therefore appear that this estimate is on the low side. The Commissioner also estimates that the average length of haul on rural roads was 7.6 miles and the average cost of hauling at least 35 cents per ton-mile. Allowing 56 million tons moved, we find that the cost of hauling this material on roads was about 149 million dollars or about 54 per cent of what was spent for freight on the railways. In 1919 the railways carried 48 million passengers at a cost of 96 million dollars and making about 3.6 billion passenger-miles. We have no records of passenger travel on roads and can only estimate again, but we know that in 1921 there were 463,848 automobiles registered in Canada. Allowing an average of two persons per car and that each car travelled 5,000 miles per year we find that automobiles made 4.6 billion passenger-miles, a considerably greater passenger-mileage than the railways. Allowing 10 cents per automobile-mile, we find that the cost of moving passengers on roads was about 232 million dollars, which is greatly in excess of money spent on railway passenger travel. This does not take into account traffic by other vehicles on roads. These figures, while only estimates, show two things, — first, that the subject of roads is important enough to warrant a careful study for, and the putting into effect of, a comprehensive road policy; and second, that the amount of service rendered to the public by roads is as great, if not greater, than that rendered by the railways.

Up to the end of 1919 we find the capital invested in railways in Canada to be over two billion dollars. To this must be added the capital expenditure of over 413 million on government railways and nearly 24 million on provincial railways making a total capital of about two and one-half billion dollars. The Dominion Government aided other than government railways to the extent of nearly 222 million dollars; the provinces over 43 million and municipalities over 16 million. They have had land grants of over 44 million acres and bonds guaranteed to the amount of 344 million dollars. These figures show the value which the public of Canada has placed on this utility which performs a service similar to that performed by the roads, but whose utility and investment would be of no value without the service given by the roads. While the railways perform a service, this service is paid for by the users of the railways and the utility is expected to pay at least interest on the money invested therein. Roads have no opportunity to show a balance sheet and must therefore depend entirely on *service* for justification of their construction.

Divisions under which a Road Policy should be Considered

The consideration of a road policy falls into two divisions: 1st, executive; 2nd, financial. Under "executive", we must first consider who will have charge of the roads. Will they be constructed and operated privately or by public bodies. This question has already been answered for us and it seldom enters our mind that they could possibly be operated by private corporations in competition with each other, although if they were operated in some such way our highway system would be in much better shape than it is to-day. It has been determined for us that they are to be under the control of some public body. Of these there are in general three bodies, who are in a position to assume this duty; (1) the Federal Government, (2) the Provincial Government, (3) the Municipal Government. To put roads under control of the Federal would in some cases probably require changes to the British North America Act.

In a railway, where the haul is inter-provincial, it is essential that one central body should have control of a complete system. In roads it is not essential that there should be one central body in control throughout the Dominion. Freight hauls and passenger travel on roads, on the average, are over short distances as compared with the railways, and a large percentage of both of these originate and terminate within one province. There remain the other two bodies: the provincial and the municipal. The first means one central organization, the second means a large number of small organizations. In order to discuss which type of control would be better let us examine what is required of the road.

Types of Traffic

As the purpose of the road is service, we must know to what type of traffic we are to render service and what it requires. It is evident that the road must be constructed to suit the traffic, (within reasonable limits), instead of expecting the traffic to suit the road.

The first two divisions to be made are; (1) serving a well developed district and, (2) serving a new district. The traffic in the developed district will be outside or through traffic, and local traffic. The through or outside traffic will consist of strangers to the road and those more or less familiar with the road and will consist nearly all of motor traffic. The local traffic will consist largely of team-drawn loads with some, (and rapidly increasing), motor truck loads, automobile traffic, (mostly of the district), and some light team traffic. The traffic to be served under the heading of "new districts" will be mostly local traffic consisting chiefly of team-drawn loads, and a very light motor traffic.

What service is required by the stranger to the road? If he is a stranger to our country he may be on a tour intending to cover a considerable distance, and will be interested in passing through the country from one city to another along main highways. The impressions which he retains of our country will depend on the enjoyment which he obtains from his trip. He probably will have a schedule laid out which he wishes to follow. To serve him the road must first of all be safe under all conditions. It must be well marked so that he may follow it at anytime with certainty and ease of mind. It must be passable at any time during the travelling season. It must be a fairly direct route from city to city and must connect up with similar roads in adjoining provinces. Road laws must be the same throughout. A similar service is required by the man who is more or less familiar with the road. To this man, safety, directness and passable conditions of the road are most essential as he will undoubtedly be driving more at night than will the stranger; and in many cases a saving in time due to

directness of route means actual dollars to him. In addition to the service required by the stranger he will require more highways, reaching more cities and towns. The roads to serve these two classes must be designed primarily for automobile traffic.

What service is required of the road for local traffic? The traffic will consist of team-drawn loads from farm to market, and from town to town; some truck loads mostly from town to town with a chance that there will develop a motor truck traffic from farm to market. There will be auto traffic from farm to town and from town to town partly for pleasure, partly for business. There will be light team traffic, school vans on some roads, and some roads will be mail routes. For team-drawn loads the road surface should be passable in any sort of weather. It should be so that the cost of transporting the load is a minimum. It should be safe under all conditions; and should be direct. For truck loads it is even more important that the roads be passable at all times. Grades are not so important as for teams but directness of route is more important. Local auto traffic demands a road safe at all times but perhaps, is not so much concerned if the road should not be first class for a few days at a time. School vans demand that the roads be in good condition at all times during the school term and especially is a safe road required for this class of traffic. The postal routes must be safe and passable at all times.

Summing up for this division of traffic it appears: First, there are three classes of traffic and consequently three classes of roads; (1) "through" traffic requiring "through" roads; (2) town to town traffic; and (3) farm to market traffic. This latter including school van routes and probably postal routes. Summing up the service which each class of traffic requires we see that all require safety; mostly all require that the road be passable at all times; next directness of route; next light grades; and then a well marked route. To all these classes there should be added the pleasure seeker or the man who is out for recreation only and who desires to see the beauty spots of the country. He is interested only in roads which are safe and passable at all times and which run through the prettiest portions of the country.

The requirements in a district being opened are quite different from the older settled district. Auto traffic will be comparatively lighter and team-drawn vehicles will constitute the greater portion of traffic. The total volume of traffic will be light and speed not such an essential item. The road ditches in many cases must serve for draining the country. The service required by a road in this country is such as to justify a much cheaper type of road than in the older districts, but nevertheless it is a very important service which they must render.

So far we have considered roads from the view point of the person who uses the road. We must also consider it from the view of the man who pays for the road. If he is a *payer* and not a *user*, in the majority of cases he does not want to spend any money on roads. If he is a *payer* as well as a *user* he wants the money spent in the manner to give the maximum value, and he wants to know where and how the money is spent.

Executive Requirements

Having considered the service requirements of the different types of traffic let us see what is required of the executive to provide this service, — evidently a competent organization and money. To give the service required by those using the road the organization must consist of men who have knowledge of how to produce the results required, and the man who pays requires that the organization consist of men who can produce the results economically. To quote partly from the Commission of Highways for Canada, the organization must consist of "– – men who have had the training and experience to meet the problems which arise – –" and who "– – have been imbued with the public service idea and the necessity in the public interest of expecting one hundred cents in the dollar in value of workmanship and materials – –". This organization is expected to be capable of gathering engineering and economic data, correlating it, applying it, and filing it; of looking after the carrying out of construction; and as fully important, if not more so, of looking after maintenance; of seeing and knowing that work is properly done, money properly expended and that accounts and records are properly kept. To do this, the organization must have men of several types of training.

Some of the data to be gathered consists of facts about the amount and type of traffic which now uses the road; facts which will govern the change in volume and type of traffic which will use the road, when it has been improved, and in the future; facts regarding the cost of construction and maintenance of different types of road, the amount and kind of service which they will render under different traffic conditions; engineering data which will enable him to design the proper type of road and bridges to render the service required; facts regarding the costs of construction and maintenance; facts regarding the different methods of carrying out work and the use of different machinery and materials. The gathering of this data requires a man with a certain sort of training. The keeping of accounts requires another type of training. Men are required with office training for detail office work. The organization of the staff and keeping it running requires a certain type of training, as well as the man who has the general direction of the carrying out of the policy and relating it to the public. Evidently then, men of several different types of training are required for an efficient organization. To give the service which was stated as required by different types of traffic we know that safety requires a smooth, even surface, a proper cross-section, strong culverts and bridges, protection of high fills, and clear view, and for through roads, uniformity. To be passable at all times means generally some type of surfacing and the proper type of surfacing for the traffic. Both of these require immediate, constant and uniform maintenance.

Where Control Should be Placed

With control in one large central body an organization can be constructed of the men with the different types of training required to give the proper service. Continuous safe roads will be constructed, marked and maintained in a uniform manner. Proper machinery can

be purchased in larger quantities and at opportune times. Gravel pits and stone quarries can be purchased for present and future use. Work can be planned and arrangements made for carrying it for some time ahead and in proper order. Authority and uniform laws can be authorized by legislation easier to one body than a great variety of laws to a large number of bodies. Arrangements for financing the work can be easier and better made. The cost of the work can be properly placed when it has once been decided how the costs shall be borne. On the other hand the provincial organization offers a greater chance for manipulation by politicians. There is an opportunity in a large organization for a large waste of funds and for over organization. The members of the organization may not take as keen an interest in the work as might members of municipal organizations. Provincial Government organizations are generally bound by fair wage schedules in having any work carried out.

Municipal organizations are free of control by provincial politicians. They are more intimately connected with the work and there is less chance of a squandering of funds. There is a probability of a keen interest being taken in the work on account of their intimacy therewith. They are not bound by fair wage schedules but free to obtain labour on an open market at competitive prices. They have intimate knowledge of the local requirements for roads. They can generally get work done cheaper by local labour in small portions than can the larger organizations. On the other hand, they cannot build up an organization of men with the different types of training required. Continuous and uniform roads will not be constructed; each municipality will construct roads according to its idea, often with no regard to continuity and sometimes each councillor will construct his own peculiar type of road in his own ward. One municipality will have safe roads and the next very poor roads. Proper machinery for construction and maintenance cannot always be purchased. Large gravel pits for future use will not likely be reserved. Materials cannot be purchased at such an advantage. Roads will not be as uniformly marked. Raising of money will be more difficult and allotting of costs cannot be so fairly done. Records will not be so well kept.

These are some of the things to be considered in deciding how the roads are to be controlled. There are also several forms of dual control which might be considered. The province to have control of some roads and the municipalities of others. The control might be under the municipality subject to certain control and approval by the province, or vice versa; and all shades and varieties of these dual controls. It would be only under ideal conditions that dual control would work out satisfactorily. After the decision as to who shall have control comes the selection of the organization. Considerable space might be devoted to consideration of this. Once the organization is properly formed, a big step towards the success of the road policy has been taken. After this comes the method of construction. The selection of the type of roads and construction is a matter of engineering detail and once the right organization with sufficient authority has been formed, these can be satisfactorily worked out.

Financing of Roads

Coming to the financial question, this might be divided into three heads: (1) How much money should be spent yearly on roads; (2) how it is to be raised; (3) on what basis will the cost be distributed. The answer to the first question is beyond the knowledge of the writer, but it appears that by a proper study of wealth produced in this country, and from a study of value which might be received from good roads, that the maximum and minimum amount which should be spent on roads could be arrived at. This appears to me to be an immense question in itself, involving not only a study of present value which would be received, but also of future benefits which might accrue. This last includes a study of our material resources, probably methods of development as related to roads, and a study and plan of the whole future development of our country. This opens to us a vision of what the road question means when considered in its wide aspects.

The second question has been answered in many ways in different provinces and countries. The money must be raised from either, (1) current revenue; (2) term debentures; (3) capital account; (4) a combination of any two or more of these methods. The selection of which method should be used is a study in itself and should be decided by men of training in financial matters who are familiar with the various factors that determine which method should be adopted. The method that would be satisfactory in one section of the country might not be satisfactory in another. If members of a community had the opportunity to loan money in small sums at a higher rate of interest than they could borrow in large sums, it might be better to borrow money for roads. This might be the case in one community and not in another. If money can be borrowed at a time when one bushel of wheat will get one dollar and paid back when one-half bushel of wheat will pay off a dollar, it might be of advantage to borrow. In a new district it might pay to borrow money to improve the roads and open up the country for settlement and the increase in wealth produced might repay several times over the money required to pay back the debt. No attempt will be made here to solve this question but merely point out that the road question is not one of simply pushing up earth with a push grader, but is one requiring the services of men of a variety of training and experience.

The third question, "On what basis will the cost be distributed," offers another field for considerable study in order to arrive at an equitable solution. In most public utilities those using the utility bear the cost; but others besides those using the roads receive benefits. The land owner who has a good road constructed by his land is receiving benefits from the road even if he lives miles away, his farm not under cultivation, and the road never used by him. It seems reasonable that he should share some of the cost of the improvement, and that the whole cost should not be carried by those using the road. If a good road tends to reduce the cost of marketing produce or enables the gardener to get his produce to the consumer in a fresher state surely the consumer is securing some benefits. If a good road enables children to get to school where otherwise they could not, who can place the benefits which may be received from the

results of the education of a child which may become the leader in our country.

The first consideration which comes to mind is, should the money be raised and the cost assessed by Federal, Provincial or Municipal Governments. It is not clear to my mind why the Dominion Government should undertake the financing of road building. The people must pay and they pay no less by paying it through the Dominion organization rather than some other. The sources of Dominion revenue are not directly connected with roads and the public services which are under Dominion control are not directly interested in roads except the postal and military services, so that the raising of money by the Federal Government appears to have no direct connection with road service nor is the money likely to be spent on roads which directly affect Federal services. However, those who are interested in this phase of road financing can undoubtedly supply adequate reasons why the Federal Government should assist in financing road construction. On the other hand the Provincial Governments obtain revenue from sources which receive service from roads, such sources as automobile license fees, direct taxes on land values, direct taxes from those who haul loads over the roads. The municipal source of revenue includes direct taxes on land values and on those who are the main users of roads. It would appear to the writer that the financing of road construction should be a function of the Provincial and Municipal Governments.

As the money must be provided by the individual, in the final analysis we must give consideration as to how the cost is to be distributed to the individuals. This might be done on the basis of ability to pay or on the basis of benefits received. While taxation on the basis of ability to pay might be a fair basis for certain government services, it does not appear to be equitable that this should be the only basis on which to secure revenue for road construction. In general, public utilities rendering similar service are paid for on the basis of service received and this appears a fair basis for obtaining a greater portion of the revenues for road construction. Its equitable application is difficult if not impossible. Those receiving most of the direct services are the users of automobiles, motor trucks, farm teams, other team loads, light teams, school vans and mail routes. The majority of automobiles and motor trucks do most of their travelling on certain main highways and town to town roads, but they do some travelling on other roads; farm teams do most of their hauling on market roads but they do some on main highways and town to town roads; the landowner, we saw, received some value; the consumer of products receives some value; and the people at large receive some value. The question is in what proportion do they receive value from good roads. We assumed that the average motorist travelled 5,000 miles per year at a cost of 10 cents per mile. If the good road reduced the cost only ten per cent it would be worth $50. per year to him; but this is away low in the saving which will be effected. In the first place you cannot run a car on poor roads for less than 15 cents per mile; secondly, the saving will be much in excess of ten per cent in the cost of running the car, and thirdly, a saving of still greater value will be made in the saving of the time of the passengers. If automobiles were taxed $50. per year and this money put into proper roads they would, on the average, still be money in pocket. With half this money we would have a yearly road fund of over 11 million dollars from this source alone. We estimated that 5[illegible] million tons of freight were hauled over rural roads at a cost of 35 cents per ton-mile. If the cost were reduced to even 30 cents per ton-mile we would effect a saving of over 6 million dollars yearly. The average value of farm land in Canada is estimated at $48. per acre. Suppose good roads were established and the value of land increased by $5. per acre, the interest on this at 6 per cent is 30 cents per year or about 6 mills per acre. Suppose we ask only one-half this value to put into roads or 3 mills. The estimated value of farms and farm buildings in Canada is over 4 billion dollars. A rate of 3 mills would give another 12 million dollars yearly. If we asked each poll to contribute 10 or 15 cents per year for general value received we would add another million to our revenue, making a total yearly revenue of about 30 million dollars. We pay the railways directly over 369 million dollars per year. The point to be brought out is that there are several classes of beneficiaries from good roads; that consideration must be given to arrive at an equitable distribution of costs, mostly on the basis of benefits received; and that when these costs are distributed on this basis each person will be paying only a portion towards the value which he will receive.

It has been possible in this paper to point out only some facts which must be considered in deciding on a road policy. The main things which should be brought out are:

(1) That Service is the first consideration in a road policy.

(2) That the road problem is a large one and worthy of consideration by able men.

(3) That men of a variety of training, of broad experience and sound judgment should be requested to give their assistance in solving the problem of what should be a proper road policy for a country.

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The Winnipeg Meeting

The Winnipeg Branch may well be proud of the successful outcome of the general professional meeting held there the first week in September. From the opening session it was stamped with the hall-mark of success which continued and increased until the final function. As one of the members remarked, having attended most of the engineering gatherings of recent years, "It seems wonderful that we can, with the fine meetings that have been held, show improvement each year, for the Winnipeg gathering is the best yet". This voices the sentiment that is representative of those present. Only those who have taken part in organizing such a meeting have any idea of the amount of detailed work involved or are in a position to appreciate the time and effort entailed upon the committees responsible. With a luncheon each day at noon and dinner at night, the programme kept the members together during the entire day, and afforded one of the best opportunities of getting acquainted that has yet been presented. Some of the papers read are notable contributions to the engineering literature of our time. The discussion at all times was indicative of an active interest on the part of those present, and the social functions were all that could be desired. The first public statement of the work of *The Institute's* committee investigating the deterioration of concrete in alkaline waters was made and appears elsewhere in this issue. This committee has done excellent work and it is anticipated that important results will be realized. To those not familiar with Manitoba, the water power development was a revelation, the facilities for visiting the new plants provided by the city of Winnipeg and the Manitoba Power Company being perfect.

The hospitable welcome by Mayor Fowler and the aldermen, the large electric sign which adorned the front of the city hall during the convention extending a welcome to *The Engineering Institute*, the newspaper comments and the distinguished guests at the banquet, all bore evidence, or paid tribute to the position the engineer occupies in the economic development of the country. The entire meeting was a splendid demonstration of the strength of the engineering profession, but above all it was a striking exemplification of the fact that the engineer is receiving greater recognition from those outside the profession.

It was an inspiration to read in the *Winnipeg Tribune* of Thursday, September 7th, the following editorial.

The Engineer

When the Waters were dried and the Earth did appear,
The Lord, He created the Engineer.

The fact that *The Engineering Institute of Canada* is in convention here makes the occasion opportune to pay a little tribute of praise to one of the most essential and one of the least appreciated of the professions.

Kipling, as usual, has told the story in a phrase. First of all comes the engineer — or at least, first after the explorer, and the engineer is frequently the explorer as well. Study almost any phase of modern life, and at the bottom will be found an engineer. When we learn to recognize the engineer, and value his services at their true worth, the world will make much more rapid progress and at the same time a great profession will come into its own.

Great trains shuttle back and forth across the continent, thundering their contempt for the roadbed that plays a humble but essential part in transportation. Somewhere a long time back an engineer hacked his way through the bush or tramped over the lone prairie, surveying the line. After him came another engineer, blasting and digging and filling until the roadbed was made and the steel laid. Other engineers were creating the machinery that constructed the locomotive and the cars, and they were made from steel. Engineers had found the iron ore, engineers had mined it, engineers had turned it into steel with the aid of chemical engineers and electrical engineers and many others.

We say casually that Canada has 18,000,000 available horse-power in hydro-electric energy. How do we know? Engineers of the hydrographic branch have been ranging the whole Dominion, measuring the

flow of rivers, many of them in the almost inaccessible fastnesses of the hinterland. Engineers first surveyed the course of the rivers, and when the time comes when hydro-electric development is possible on any of them, engineers will choose the site, engineers will construct the dams and the power-plants and the transmission lines. The development of the hydro-electric power of Manitoba is one of the greatest factors shaping the destiny of this province and its people. Engineers were essential at a hundred points in that great enterprise.

A great bridge costing many millions of dollars is to be erected. Engineering brains must figure the stress and strain on each little strut or girder, even each bolt in the structure. A highway is planned — engineers must figure gradients and drainage and materials and construction. A great building is to be erected, and engineering accuracy is called to find out what foundations are necessary. A city requires water, and the engineer is the man who finds it and brings it in and distributes it. Does concrete work crumble under the action of alkaline water? Turn to the engineer. What radiation is necessary to heat a space of 200,000 cubic feet? Ask the engineer. What is the wind stress against a great illuminated sign high in the air? Consult an engineer.

The engineer is the brains of construction and development. The capitalist supplies money, the workingmen supply labour, the management furnishes direction and initiative. The engineer's job is to say what can be done and how it can be done — and he must know, for guess-work is foreign to his nature.

His work is lost sight of by the public. It hardly knows that he is there, and never stops to think. That is one of the reasons why the profession does not stand as high as it should in the public estimation. Another reason is the fact that anyone who can screw two lengths of pipe together, or erect a flag-pole, thinks that he is entitled to call himself an engineer — and does.

An enlightened public opinion on this subject is much to be desired. The standards required before the title of engineer is conferred should be as high as the standards required for an "M.D." after a name.

It is a noble profession, and one of the greatest. Let us hope that greater recognition will come to it.

Employment Conditions Improved

For the past two years the employment situation in Canada has left much to be desired but it is gratifying to report that for several months there has been a gradual improvement to the extent that the situation is apparently better than it has been at any time for many months.

According to L. W. Wallace, executive secretary of the Federated American Engineering Societies, conditions are steadily improving, the outlook has grown more hopeful, and increased employment opportunities prevail rather uniformly in the major branches of engineering. The August report of the American Association of Engineers carries the same optimistic note, and while pointing out the labour difficulties, refers to the prediction that there will be considerable activity, increased production and increased work this fall. Dean Cooley, president of the Federated American Engineering Societies, has announced the purpose of the federation to formulate a permanent and constructive engineering policy as to unemployment which offers food for thought for *The Institute*, both in relation to a greater effort to insure, as far as practicable, continuity of employment and also to bring the engineering mind to bear on the subject of unemployment in general.

Suggested Code of Ethics

A joint committee under the chairmanship of Mr. J. G. Christie, consisting of representatives of the American Society of Civil Engineers, American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Institute of Mining and Metallurgical Engineers and the American Society of Heating and Ventilating Engineers, has been working for some time with the object of drawing up a code of ethics that might be adopted by all of the engineering societies whose policy is to uphold the dignity and honour of the engineering profession. Correspondence between Mr. Christie and *The Institute* reveals the suggestion that *The Institute* consider the proposed code. Members will recall that the Committee on Policy recommended the appointment of a special committee, and at the last meeting of Council a committee consisting of Councillors Arthur Surveyer, F. P. Shearwood and Frederick B. Brown, was appointed to consider the proposal and report to Council. This committee is fortunate in having the work of the American societies' committee before them. The report of the joint committee together with the suggested code follows.

Report of the Joint Committee on a Code of Ethics for Engineers

The Joint Committee consisting of representatives of the American Society of Civil Engineers, the American Institute of Mining Engineers, The American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Society of Heating and Ventilating Engineers, appointed to consider a Code of Ethics for Engineers recommends, after deliberate consideration, that each participating Institute or Society adopt the short simple Code of Ethics following this report.

The Committee further recommends that the following method of interpreting and administering the Code be adopted by each participating Institute or Society after any necessary provisions have been made in the Constitution and By-Laws of the organization.

"The President of each Society or Institute shall appoint a *Standing Committee on Professional Conduct*, to administer the Code of Ethics. The duties of such a Committee shall be to interpret the Code and to render opinions on any cases of questionable conduct on the part of members that may be submitted to the Committee. These interpretations shall be reported to the Executive Board of the Institute or Society who may approve these interpretations, or take such other action as may seem just and necessary. The reports of the Committee on Professional Conduct when approved by the Executive Board, shall be printed in abstract *and in anonymous form* in the Institute's or Society's monthly journal for the instruction and guidance of fellow members.

This Committee on Professional Conduct shall be appointed in each Institute or Society by the President holding office at the time of the adoption of this Code and shall consist of five members, one appointed for five years, one for four years, a third for three years, a fourth for two years and a fifth member for one year only. Thereafter, the President then holding office shall appoint one member annually to serve for five years, and shall also fill any vacancies that may occur for the unexpired term of the member who has withdrawn. These appointments shall be made from among the older members of the Institute or Society, so that advantage may be taken of their nature experience and judgment. The Committee after appointment shall elect its own chairman and secretary. The Committee shall have power to secure evidence or other information in any particular case not only from the organizations own members, but if it should seem desirable, from men in other professions. The Committee may also appoint sub-committees to consider certain cases when deemed necessary.

This Committee shall investigate all complaints submitted to it *by the Secretary of The Institute or Society* bearing upon the professional conduct of any member and after the member involved has been given a fair opportunity to be heard, the Committee shall report its findings to the Executive Board of the Institute or Society. This report may in some cases suggest certain procedure of the Executive Board.

The Executive Board of the Institute or Society shall have power to act on the recommendation of the Committee on Professional Conduct, either (1) to censure by letter the conduct of the member who has acted contrary to the Code, if the breach is of a minor character, or (2) to cause the members' name to be stricken from the roll of the Institute or Society.

Copies of all reports made by a Committee on Professional Conduct to the Executive Board of each Institute or Society shall be furnished to each other Committee on Professional Conduct administering the

Code. This will keep each Committee advised of the interpretations of other Committees, and in time an extended interpretation of the Code can be written based on the reports of the various Committees on Professional Conduct.

As interpretations of the various Committees on Professional Conduct administering this Code may vary at times, it is recommended that the Chairmen of these Committees of the various Institutes or Societies be authorized to act as a Joint Committee to review such differing interpretations and to bring them into unity with one another."

Respectfully submitted,

Joint Committee on Code of Ethics

A.S.C.E.:— C. C. Elwell, A. M. Hunt.
A.I.M.E.:— J. Parke Channing, Philip W. Henry.
A.S.M.E.:— A. G. Christie, *Chairman;* J. H. Hinchey, Chas. T. Main, J. V. Martenis, Robert Sibley.
A.I.E.E.:— Comfort A. Adams, G. Faccioli, Geo. F. Sever, L. B. Stillwell.
A.S.H.V.E.:— Frank T. Chapman, S. A. Jellett, Perry West.

A Code of Ethics for Engineers

Engineering work has become an increasingly important factor in the progress of civilization and in the welfare of the community. The Engineering Profession is held responsible for the planning, construction and operation of such work and is entitled to the position and authority which will enable it to discharge this responsibility and to render effective service to humanity.

That the dignity of their chosen profession may be maintained, it is the duty of all engineers to conduct themselves according to the principles of the following Code of Ethics:

1. The Engineer will carry on his professional work in a spirit of fairness to employees and contractors, fidelity to clients and employers, loyalty to his country and devotion to high ideals of courtesy and personal honour.
2. He will refrain from associating himself with or allowing the use of his name by an enterprise of questionable character.
3. He will advertise only in a dignified manner being careful to avoid misleading statements.
4. He will regard as confidential any information obtained by him as to the business affairs and technical methods or processes of a client or employer.
5. He will inform a client or employer of any business connections, interests or affiliations which might influence his judgment or impair the disinterested quality of his services.
6. He will refrain from using any improper or questionable methods of soliciting professional work and will decline to pay or to accept commissions for securing such work.
7. He will accept compensation, financial or otherwise, for a particular service, from one source only, except with the full knowledge and consent of all interested parties.
8. He will not use unfair means to win professional advancement or to injure the chances of another engineer to secure and hold employment.
9. He will co-operate in upbuilding the Engineering Profession by exchanging general information and experience with his fellow engineers and students of engineering and also by contributing to work of engineering societies, schools of applied science and the technical press.
10. He will interest himself in the public welfare in behalf of which he will be ready to apply his special knowledge, skill and training for the use and benefit of mankind.

Secretary Rice Represents E.I.C.

Calvin W. Rice, whose remarkable success as secretary of the American Society of Mechanical Engineers is well known, was appointed by that society and several other engineering societies and organizations to represent them at the great engineering congress now being held at Rio de Janeiro. As Mr. Rice has always been a warm friend of *The Institute*, he kindly offered to act as official delegate, which offer was gladly accepted by the Council, so that at that important gathering *The Institute* will be well represented.

David Thompson

Explorer, Geographer and Scientist

How little we know of the great men who toiled unceasingly and endured untold hardship in the pioneer days of Canada's vast northwest. Only recently the people of Canada learned with astonishment that David Thompson, one of the country's foremost explorers, had died unnoticed more than half a century ago, within a few miles of Montreal.

On August 30th, 1922, a memorial to the late David Thompson was opened at Lake Windermere, B.C., and on the same day a memorial service was held at his graveside in Montreal. In this way, after many years, the passing of one of our most notable pioneers was told.

What is known of the life work of David Thompson is narrated in "An Appreciation" prepared by J. B. Tyrrell, F.R.S.C., on the occasion of the opening of the memorial at Lake Windermere, from which the following are extracts:—

"David Thompson was the greatest land geographer who ever lived; and, therefore, one of the greatest scientists. He came to Fort Churchill a 14-year-old boy from a London charity school in 1784. While his greatest work was being done during twenty-eight years, he was never within a thousand miles of any civilized community of five hundred souls. He died in obscure poverty sixty-five years ago and lies in a nameless grave at Montreal. The opening of the memorial museum and hall at Lake Windermere, B.C., is the first public recognition of the debt that civilization owes him, for, though the Thompson River is called after him, a few years ago not one geographical student in a thousand knew anything about him.

With extraordinary accuracy he placed on the map the main routes of natural travel in one million two hundred thousand square miles of Canada and five hundred thousand square miles of the United States; he surveyed the head waters of the Mississippi; he discovered a new route to Lake Athabasca; he opened the first trade between what is now Canada and the territory beyond the Great Divide; he fixed the locations of outstanding geographical points over this vast area with the sureness of an expert astronomer, though he had to learn how to figure with the stars when he was a boy wintering at Cumberland House on the Saskatchewan River.

His skill won for him the appointment of Astronomer to the Commission which, from 1816 to 1826, delimited the frontier between British North America and the United States. Some of his surveys are included in the official maps now being issued. His "Narrative," published in 1916, is a wonderful story of life in the wilderness and contains very much information of the prehistoric exlxtence of the Indians never given elsewhere. So far as is known, he is the only man who has ever surveyed the Columbia from source to mouth, 1150 miles. His locations are as accurate as others which have been made with the most modern instruments and the most recent almanacs that Government Departments can buy. The record of his work is contained in forty notebooks, which have long been in the possession of the Ontario Government. Their story, for unremitting labor, conscientious devotion to science, and for the unconscious evidence they give of a noble character, so far as a somewhat extensive research enables one to judge, is not equalled by anything that has been left by all the explorers whose names are honoured wherever our language is read.

I have called Thompson one of the greatest of scientists. His work is open for inspection. It is the more remarkable because, not only was a great deal of it performed literally thousands of miles from the outskirts of civilization, but because, except for one year, it was a side-line to his activity as a fur trader, first for the Hudson's Bay Company and then for the North-West Company, which afterwards was united with it. He travelled almost incessantly during spring, summer and fall — often most hazardous travel, such as is told in the journal of his opening of a new route to Lake Athabasca, during which he was almost drowned, and was within a few hours of death by starvation.

The remains of his Fort Kootenae are just outside the town of Athalmere. The degrees of latitude are located as from Greenwich. Thompson's log house here was six thousand miles from Greenwich, to com

municate with which, in his day, required several months of travel. Thompson's location of this place by his observations of the stars was within four miles of its precise spot on the earth's surface. His location of Cumberland House is within one mile of exactitude — nearer than the Capitol at Washington was placed by the foremost scientists up to the time when the Atlantic cable brought Washington into instantaneous communication with Greenwich Observatory.

Thompson toiled in the wilderness without thought of the public distinctions that usually incite scientific men. He never learned to advertise. He suffered privation in his old age without a murmur. With a noble humility he exemplified the Christian virtues during nearly thirty years in the wilderness, where not a single missionary had ever been. For what he did and what he was he deserves to be held in everlasting homage."

Approval of Cement Specifications

The standard specification for Portland Cement issued by the Canadian Engineering Standards Association under the date of February 22nd, 1922, being a revision of *The Engineering Institute's* specification, was approved by the Council at the August meeting.

OBITUARY

Major Robert W. Powell, M.C., A.M.E.I.C.

News of the death of Major Robert W. Powell, M.C., A.M.E.I.C., of Ottawa, while engaged in engineering work at Bay D'Espoir, on September 4th, has been received with deep regret by his many friends within the profession. Born in Ottawa on October 11th, 1891, he received his primary education in the public schools and Collegiate Institute of that city, later attending Royal Military College, Kingston, from which he graduated in 1911. After graduating, Major Powell was engaged for a short time on railway location work for the Canadian Northern Railway, and in the same year he accepted the position of assistant to the superintendent, St. Charles River Import Works. In March 1912, he was appointed as assistant engineer in the Public Works Department at Ottawa, and the following year joined the staff of S. J. Chapleau, M.E.I.C., in the same department. Major Powell's war record was outstanding. He joined the Canadian Engineers in September 1914 as Lieutenant in the 4th Field Company, and was Adjutant of the 4th Divisional Engineers during mobilization, later being transferred to the 11th Field Company. He was wounded three times during 1916 and won the Military Cross and Bar to Military Cross. In 1917 he was returned to Canada and was appointed chief instructor of the Engineers Training Depot at St. Johns, Que., where he was promoted to the rank of Major. At the end of the war he was appointed assistant engineer for the Department of Railways and Canals on section No. 3, of the Welland ship canal, on which work he was engaged from March 1919 until the end of 1920. He then became interested in hydro-electric power investigations, and it was on this branch of work that he was engaged near Bay D'Espoir, Newfoundland, when he died.

PERSONALS

E. E. Down, A.M.E.I.C., is with the Department of Public Highways of the province of Ontario, as instrumentman on work near Simcoe, Ont.

Alec. W. Barnes, A.M.E.I.C., has returned from England, where he has been for the past six months, and is now located in Edmonton, Alta.

Morley V. Powell, S.E.I.C., has accepted a position as demonstrator in the thermodynamics laboratory, of the Faculty of Applied Science, University of Toronto.

W. S. Collins, Jr.E.I.C., is with the Manitoba Power Company at Great Falls, Manitoba, where the new hydroelectric power plant is being installed for this company.

J. LeRoy Underhill, Jr.E.I.C., of Campbellton, N.B., is now located at Montpelier, Vt., with the State Highway Board in connection with the roads work for the State.

R. H. Farnsworth, Jr.E.I.C., is with the St. Lawrence Paper Mills Limited, at Three Rivers, Que., where he is engaged in design work for the company.

H. L. Humes, S.E.I.C., who graduated in metallurgical engineering from McGill University last spring, is now on the staff of the university as Fellow in Metallurgical research.

T. W. Brown, A.M.E.I.C., who until recently has been located in Saskatoon, Sask., has opened an office in the McArthur building, Winnipeg, where he is engaged in engineering and general contracting work.

G. R. Elliott, A.M.E.I.C., is with Cosden and Company at Tulsa, Oklahama, engaged in geological field work in that state. Mr. Elliott is a graduate of the University of Toronto of the class of 1911.

Alf. A. Oldfield, A.M.E.I.C., has been appointed engineer of maintenance of way, and assistant to the manager of the Eastern Wisconsin Electric Company, of Oshkosh, Wis., U.S.A.

S. Eastman Root, S.E.I.C., is with the Thompson Starrett Company, at Three Rivers, Que., on the engineering staff on the construction of the mill of the St. Lawrence Paper Mills Limited.

T. L. Crossley, A.M.E.I.C., is supervisor of education in English, of the Institute of Industrial and Domestic Arts, Department of Pulp and Paper Making, which is located in Toronto, at 208 King Street, West.

T. C. Thompson, Jr.E.I.C., of Montreal, is on the staff at McGill University as demonstrator in electrical engineering. Mr. Thompson received his degree of B.Sc. from McGill in 1920.

E. E. Holmes, S.E.I.C., of Westmount, Que., is now connected with the St. Lawrence Supply Company, Ltd., Montreal. Mr. Holmes is a graduate of McGill University and has until recently been on the engineering staff of the Wayagamack Pulp and Paper Company.

C. J. Lacy Sanderson, A.M.E.I.C., of Acme, Alta., has been appointed to the staff of the district engineer and surveyor for the government of the province of Alberta at Calgary, Alta., and is in charge of a survey party engaged in locating new roads in that district.

John Pinder-Moss, Associate E.I.C., has been appointed director of the Northern Polytechnic Institute of British Columbia at Prince Rupert, B.C., into which institute has been merged the Granby Bay Polytechnic of Anyon.

Kenneth M. Ramsey, S.E.I.C., of Montreal, who graduated this year from McGill University, has been appointed production engineer with the Thompson Starrett Company, at Three Rivers, Que., on the construction of the new mill for the St. Lawrence Paper Mills, Ltd.

George B. Dorey, A.M.E.I.C., formerly assistant mechanical engineer of the Hart-Otis Car Company, is now with the Enterprise Railway Equipment Company of Chicago, Ill. Mr. Dorey had been connected with the Hart-Otis Car Company since 1907 with the exception of two years on military service.

Dudley J. Shrimpton, S.E.I.C., of Westmount, Que., is with the Ford Company, at Windsor, Ont. Since graduating in mechanical engineering from McGill University in 1920, Mr. Shrimpton was on the staff of the mechanical engineer of the Steel Company of Canada, prior to accepting his present position.

W. N. Ryerson, M.E.I.C., formerly general manager of the Great Northern Power Company at Duluth, Minn., has recently resigned to join the management department of Day and Zimmermann, Inc., engineers, of Philadelphia, Pa., which firm operates eighteen public utility properties in the eastern states, including electric light and power, gas, and electric railway enterprises.

Alan Ferrier, A.M.E.I.C., has been appointed to the staff of the Technical Branch of the Canadian Air Force and is located in Ottawa. Mr. Ferrier is a graduate of McGill University having received his degree of B.Sc. in 1920 and following graduation he was employed with T. Pringle and Son Ltd., engineers and architects, Montreal.

H. L. Vercoe, M.E.I.C., who was in 1919 resident engineer in charge of construction of the new power plant for the Manitoba Power Company at Great Falls on the Winnipeg river and later inspecting engineer on the Grand Trunk Railway arbitration at Winnipeg, is now with the Appalachian Power Company, Engineering Department, at Bluefield, W.Va.

Thomas Shanks, M.E.I.C., D.L.S., acting surveyor general, is at present on a trip throughout western Canada, for the purpose of visiting some of the surveyors who are on active field service and conferring with some of the provincial officials over some of the problems closely identified with the work of the Topographical Surveys Branch, Department of the Interior.

D. Roy Paterson, Jr.E.I.C., of Galt, Ont., is located at Morpeth, Ont., having recently joined the staff of the Webster Construction Company, of London. On returning from overseas in 1919 Mr. Paterson was articled on D.L.S. work in Saskatchewan, and later was appointed assistant city engineer of Galt, Ont., from which position he resigned in May of this year to join the company he is now with.

Frederick H. Fay, M.E.I.C., is the senior member of the firm of Fay, Spofford and Thorndike, consulting engineers of Boston, Mass., which firm has recently announced that they have admitted to partnership, Messrs. John Ayer, Bion A. Bowman, Carroll A. Farwell, Ralph W. Horne, Ralph T. Jackson, George L. Mirick, Barzillai A. Rich, Warren D. Trask, who have been long associated with the firm. The name of the firm is to remain as heretofore.

John F. Bell, O.B.E., R.N., M.E.I.C., has recently retired from the Royal Navy and is now resident in Toronto. Mr. Bell was born in Carlisle, England, and received his engineering training at City and Guilds Technical College, London, Greenwich Naval Engineering College, and by private tuition. He entered the Royal Navy in 1898 and after rapid promotions entered the war period as Engineer Lieutenant Commander, and was later promoted to Engineer Commander, retiring this year as Engineer Captain.

Major General Garnet B. Hughes, C.B., C.M.G., D.S.O., M.E.I.C., is now located at 175 Piccadilly, London, W. 1., where the firm of G. B. Hughes and Company, Ltd., is engaged in public works contracting. After graduation from R.M.C., in 1901 General Hughes was for a number of years engaged in railway work in various parts of the country as assistant to the chief engineer of the Canadian Northern Railway. He was for two years, general superintendent in charge of construction of the Cia de Augua y Drenaje de Monteerey, Mexico, in connection with water-supply and drainage work. Following his distinguished service overseas he became, at the close of the war, managing director of the British Cellulose and Chemical Manufacturing Company, Ltd., at Spondon, near Derby, England.

F. Theo. Gnaedinger, A.M.E.I,C., formerly secretary-treasurer, Sault Ste. Marie Branch, is now located in Three Rivers, Que., having accepted the appointment of resident engineer for T. Pringle and Son, Limited, of Montreal, in charge of certain changes which are being made at the plant of the Wabasso Cotton Company. Mr. Gnaedinger graduated from McGill University in 1912, and during the same year was employed on construction work and field engineering with the Algoma Steel Company at the Soo, with which company he had previously been employed during his college course. In July, 1912, he was appointed field engineer of the Lake Superior Paper Company, now the Spanish River Pulp and Paper Mills, Limited. In 1913, he was engaged on hydro-electric power investigation for the Mond Nickel Company, and in the two succeeding years was resident engineer on the construction of the power development at Nairn Falls. At the close of the war, during which he served in the Canadian Railway Troops, he entered the employ of the Algoma Steel Corporation on the construction of the new combination rail and structural mill, which position he held until coming east to take up the new work on which he is now engaged.

Recent Visitors at Headquarters from out of town

D. W. McLachlan, M.E.I.C., Ottawa; Chas. W. Dill M.E.I.C., Winnipeg; W. H. Breithaupt, M.E.I.C., Kitchener C. G. Moon, A.M.E.I.C., Ottawa; K. M. Cameron, M.E.I.C. Ottawa; J. L. Rannie, M.E.I.C., Ottawa; J. W. Roland M.E.I.C., Halifax; Frank B. Thompson, S.E.I.C., Toronto P. Manning, A.M.E.I.C., Peterborough; C. R. McCort A.M.E.I.C., Three Rivers; Ernest Lavigne, A.M.E.I.C. Quebec; M. Wolff, A.M.E.I.C., Ottawa; W. A. Winfield M.E.I.C., Halifax; B. J. Saunders, M.E.I.C., Halifax; Frank P. Vaughan, M.E.I.C., St. John; B. A. Yandall, A.M.E.I.C. Kirkland Lake.

EMPLC

MEM ...HANGE

To make this department more valuable it is proposed that in future advertisements of situations vacant should state salary, and give details of requirements.

Situations Wanted

Mechanical Engineer

Engineer, Jr.E.I.C., age 24, seven years experience mechanical drafting, designing and engineering, including supervision over manufacture of special machinery, design of tools, jigs and fixtures for the manufacture of iron working machine tools, railways motors and controllers, improvement of lathes, shapers, drills, etc.; desires change. Salary expected $165 per month. Apply Box No. 119.

Position desired in South America

Institute member desires position in South America, having had six years experience there, and understands the language. Has experience in railway work and construction, also experience as a sales engineer. Apply Box No. 116-P.

Situation Vacant

Principal Statistical Clerk

A Principal Statistical Clerk (Male), in the Mining, Metallurgical and Chemistry Branch, Dominion Bureau of Statistics, Department of Trade and Commerce, Ottawa, at an initial salary of $1,800 per annum, which will be increased upon recommendation for efficient service at the rate of $120 per annum, until a maximum of $2,280 has been reached. This salary will be supplemented by whatever bonus may be provided by law.

Duties. — To perform difficult, highly specialized work of a clerical nature involved in the collection, compilation, checking, correction and tabulation of statistical data; editing of data obtained from chemical industries, with a view to establish correctness of details; preparation of reports relating thereto; correction and compilation of data with regard to special inquiries, and other related work as required.

Qualifications. — Education equivalent to graduation in chemistry from a university of recognized standing; at least two years' experience in industrial chemical work; supervisory ability; considerable knowledge of modern office methods. Candidates are requested to forward with their applications any diplomas or certificates received by them, or certified copies of such, which may have a bearing on their qualifications for this position. While a definite age limit has not been fixed, age may be a determining factor when making a selection.

Application forms properly filled in must be filed in the office of the Civil Service Commission not later than October 12th. Application forms may be obtained from the offices of the Employment Service of Canada, from the Postmasters at Prince Rupert, Vancouver, Victoria, Edmonton, Calgary, Regina, Winnipeg, Quebec, Charlottetown, Halifax, Fredericton, and St. John, or from the Secretary of the Civil Service Commission. By Order of the Commission, W. FORAN, *Secretary*.

ELECTIONS AND TRANSFERS

At the meeting of Council held on September 25th 1922, the following elections and transfers were effected:—

Members

Condon, Frederick Oxley, district engineer, Canadian National Railway, Moncton, N.B.

Fogarty, Orville Alden, engineer, Pennsylvania Mold and Iron Corporation, Pittsburgh, Pa.

Howard, Rupert Fortescue, B.Sc. (McGill Univ.), consulting engineer, 416, Phillips Place, Montreal, Que.

Lash, Norwood Maxwell, (grad. S.P.S. Toronto), chief engineer, Bell Telephone Company of Canada, Montreal, Que.

McKenna, John Andrew, B.Sc. (Mech. Eng. — Mass. Inst. of Technology), senior asst. engr. and controller of military lands, Engineer Services, Major C.E., O.C. 3rd field Company, Canadian Engineers.

Nash, Thomas Sanford, D.L.S., in chg. of a major divn. of Topog'l. Surveys Branch of the Dept. of the Interior, Ottawa, Ont.

Associate Members

Babcock, Harold Austin, B.A.Sc., (Univ. of Toronto), with James, Proctor & Redfern, Toronto, Ont.

Bailey, Harold Milton, supt., Public Works and Utilities, Town of Melfort, Sask.

Bannantyne, Ninian, senior engr., H.M.C.S. "Aurora", Halifax, N.S.

Bennett, George Arthur, B.A.Sc. (C.E. — Univ. of Toronto), chief of party, Topog'l. Surveys Branch, Dept. of the Interior, Ottawa, Ont.

Bisson, Joseph Leonard, B.Sc. (C.E. — McGill Univ.), senior asst. engr., Dept. Public Works, Canada, at Fort William, Ont.

Boulton, William James, B.A.Sc. (Univ. of Toronto), chief of party, general surveys, Topog'l. Surveys Branch, Dept. of the Interior, Ottawa, Ont.

Bradley, Nicholas Hilburn, D.L.S. & A.L.S., asst. to dist. surveyor and engr. Surveys Branch, Dept. Public Works, Alta.

Brenot, Lucien Edward Honore, D.L.S., chief in chg. of party on topog'l. and land classification surveys, Ottawa, Ont.

Fenner, Thomas Henry, editor, "Power House" and "Marine Engineering of Canada", Toronto, Ont.

Forde, Elroy, Lt.-Col., D.S.O., asst. director of signals for Canada, Dept. of Militia and Defence, Ottawa, Ont.

Gladman, Victor Lionel, B.Sc. (McGill Univ.), chief engr., Sproatt & Rolph, Archt's., Toronto, Ont.

Hardouin, Joseph, D.L.S., in charge of party topog'l. survey work in Southern Alberta, of Ottawa, Ont.

Hill, Percy Pridmore, dftsman., engr'g. dept., Montreal Public Service Corporation, Montreal, Que.

Hutton, Lionel Alfred Bennett, inspector of telegraphs, C.P.R., Calgary, Alta.

May, Alex Harvey, B.A.Sc. (E.E. — Charlottenburg Univ.), consltg., elect'l., mech. and genr'l. engr., Walkerville, Ont.

McCloskey, Michael D'Arcy, D.L.S., chief of party, Topog'l. Surveys Branch, Dept. of the Interior, Ottawa, Ont.

McDougall, Samuel G., B.A.Sc., (Univ. of Toronto), civil engr., specializing in physical appraisal work, Ottawa, Ont.

McElhanney, Thomas Andrew, B.A.Sc. (Univ. of Toronto), asst. controller of surveys, Topog'l. Surveys Branch, Dept. of the Interior, Ottawa, Ont.

McKay, Robert B., B.Sc. (Queen's Univ.), surveys engr., Topog'l. Surveys Branch, Dept. of the Interior, Ottawa, Ont.

Melville, James Learmonth, Capt. M.C. and Bar, Unit Director of Administration for Eastern Ontario, D.S.C.R., Ottawa, Ont.

Paoli, Ambrose Aloysius, B.Sc. (Queen's Univ.), of Kingston, Ont.

Richmond, John, B.A.Sc. (Univ. of Toronto), chief of inspection, laboratory dept., Northern Electric Co., Montreal, Que.

Ross, Joseph Hope, acting Principal, Provincial Institute of Technology and Art, Calgary, Alta.

Slipper, Stanley Eades, B.Sc. (Queen's Univ.), petroleum engr., Mining Lands and Yukon Branch, Dept. of the Interior, Calgary, Alta.

Steers, Francis Paul, D.L.S., engr. (in charge, detailed topog'l, survey of City of London), Ottawa, Ont.

Thomas, Cecil Oldrieve, fuel engr., Montreal Light Heat & Power Company, Montreal, Que.

Watt, George Herbert, (Grad. S.P.S. Toronto), asst. office engr., in division of surveys information, Topog'l. Surveys Branch, Ottawa, Ont.

Westland, Clarence Robert, B.Sc. (McGill Univ.), geodetic engr., Geodetic Survey Branch, Dept. of the Interior, Ottawa, Ont.

Whillans, Thomas Oliver, B.Sc. (Queen's Univ.), asst. patent examiner, Canadian Patent Office, Ottawa, Ont.

Wilson, William Gillespie, asst. gen. supt. in charge of mills, Dominion Iron & Steel Co., Sydney, N.S.

Wrong, Frederick Hay, B.A.Sc. (Univ. of Toronto), asst. D.L.S., Topog'l. Surveys Branch, Dept. of the Interior, Ottawa, Ont.

Juniors

Fahey, James Vincent, B.Sc. (Queen's Univ.), hydrometric survey, hydraulic dept., Spanish River Pulp & Paper Mills, Ltd., Sault Ste. Marie, Ont.

Medlar, George Elmer, engr. in charge of field and office work for the Essex Border Utilities Commission, Windsor, Ont.

Murphy, Alexander Gordon Silcox, B.Sc., (McGill Univ.), of Westmount, Que.

Rickards, Charles Selby, meter engr., Abitibi Power & Paper Co., Iroquois Falls, Ont.

Transferred from the Class of Associate Member to that of Member

Beatty, James A., with Morrow & Beatty, Limited, Peterborough, Ont.

Black, Maurice W., (Grad. S.P.S. Toronto), chief engr. and managing director, Concrete Builders Limited, Fredericton, N.B.

Edwards, Harold, A.B. (Harvard Univ.), consltg. & constrn. work, President, Harold Edwards, Limited, Winnipeg, Man.

McLean, William Brown, B.Sc. (McGill Univ.), Vice Pres. and Mng'g. Director, Maple Leaf Manufacturing Co., Ltd., Montreal, Que.

Marrotte, Louis Henry, B.Sc. (McGill Univ.), asst. to chief engr., Montreal Public Service Corporation, Montreal, Que.

Pardoe, William Sprague, B.A.Sc. (Univ. of Toronto), Instructor and Asst. Professor in C.E., Univ. of Pennsylvania, Philadelphia, Pa.

Paulin, Frederick William, O.L.S., mn'g. director, Canadian Engineering & Contracting Co., Ltd., Hamilton, Ont.

Philips, Hector Somerville, engr. in charge sewerage design, City of Hamilton, City Engineer's Dept., Hamilton, Ont.

Smith, J. Warren, designing engr., Toronto Transportation Commission, Toronto, Ont.

Transferred from the Class of Junior to that of Associate Member

Auld, Robert Whyte, of Calgary, Alta., asst., location party (Dom. Govt.) N. Saskatchewan project.

Kendall, Ralph, constrn. engr., Dominion Coal Company, Glace Bay, N.S.

Parker, Irving Holman, supervising engr., Wm. I. Bishop, Ltd., and P. Lyall & Sons, (associated on Chambly Road Contract) Montreal, Que.

Whittaker, Herbert James, private practice, Calgary, Alta.

Transferred from the Class of Student to that of Associate Member

Brouse, Eldridge Dean Gooderham, B.A.Sc. (Univ. of Toronto), vice pres. and asst. mgr., Norman McLeod Limited, Engr'g. Contractors, Toronto, Ont.

Transferred from the Class of Student to that of Junior

Bishop, Trenholme Allen Gill, B.Sc. (E.E. — McGill Univ.), engr., engr'g. dept., Montreal Public Service Corporation, Montreal, Que.

Bowman, Nelson, B.A.Sc. (civil — Univ. of Toronto), complete chg. of erection of a concrete grain elevator and workhouse, Dominion Linseed Oil Co., Baden, Ont.

Dick, Victor William, B.Sc. (E.E. — Univ. of Manitoba), correspondent, detail division, Correspondence Dept., Canadian Westinghouse Co., Sales Dept., Hamilton, Ont.

Dunbar, John Robert, B.Sc. (E.E. — McGill Univ.), electr'l. engr., Canadian Westinghouse Co., Hamilton, Ont.

McLennan, Logan Seaforth, B.Sc. (McGill Univ.), of Vancouver, B.C.

Myers, Harold Raymond, of Stratford, Ont.

Robertson, Charles Forman, B.Sc. (N.S. Tech. Coll.), asst. to supervisor of mtce., Maritime Telegraph & Telephone Co., Ltd., Halifax, N.S.

General Professional Meeting, Winnipeg, September 5th, 6th, 7th, 1922

Visit to Great Falls Development, Manitoba Power Company, Ltd.

BRANCH NEWS

Lakehead Branch

Geo. P. Brophy, A.M.E.I.C., Secretary-Treasurer.

On September 12th, 1922, in the City Council Chamber, Port Arthur, Ont., with an attendance of over thirty persons, of whom sixteen were already members of *The Institute*, the *Lakehead Branch* of *The Engineering Institute of Canada* was organized.

The meeting was called to order by G. H. Burbidge, M.E.I.C., of the Department of Public Works, Canada, who was mainly responsible for the organizing of the Branch. Mr. Burbidge, in a short address, explained why a Branch of *The Engineering Institute of Canada* was needed in the Twin Cities and then called upon Fraser S. Keith, general secretary of *The Institute*, who had stopped off on his way east after attending the General Professional Meeting in Winnipeg, to address the meeting.

G.H. BURBIDGE, M.E.I.C.
Chairman Lakehead Branch.

Mr. Keith outlined the objects of *The Institute*, to promote the professional interests of its members, to facilitate the acquaintance and interchange of professional knowledge, to encourage original research, to develop and maintain high standards in the engineering profession, and to enhance the usefulness of the profession to the public. He also gave a short history of *The Institute*, showing how it has grown from a few branches in the east to Branches in every place of any size throughout the Dominion. He announced that the *Lakehead Branch* is the twenty-third Branch of *The Institute*. Mr. Keith's address was greatly appreciated by all and a vote of thanks was tendered to him.

Mr. Burbidge then asked R. L. Dobbin, M.E.I.C., of Peterborough, a member of this year's Council, to address the meeting. Mr. Dobbin, in a short address, outlined the organization and activities of the Peterborough Branch, which he was instrumental in forming, and passed on to the local members hints on the conduct of meetings. Mr. Dobbin's address was loudly applauded, and he also was tendered a vote of thanks.

The election of officers was then held and resulted as follows:—chairman, G. H. Burbidge, M.E.I.C., Port Arthur; vice-chairman, H. S. Hancock, A.M.E.I.C., Fort William; secretary-treasurer, Geo. P. Brophy, A.M.E.I.C., Port Arthur; and executive committee: J. Antonisen, M.E.I.C., and W. T. Moodie, M.E.I.C., for Port Arthur, G. R. Duncan, A.M.E.I.C., and D. G. Calvert, A.M.E.I.C., for Fort William.

Meetings will be held on the first Monday of each month alternately in Port Arthur and Fort William, the first meeting to be held in Fort William.

Mr. Keith then addressed the meeting again, urging the members to co-operate with the other clubs in the district to do a public service. He also emphasized the importance of making the meetings social, as well as technical, this being necessary to hold the interest of the younger members. He stated that the local Branch was in a good position to get in touch with prominent members of the profession who would be travelling east or west, and inviting them to stop off at the Twin Cities to address the Branch.

The following attended the meeting:—J. Antonisen, M.E.I.C., city engineer, Port Arthur; G. H. Burbidge, M.E.I.C., Public Works, Canada, Port Arthur; W. T. Moodie, M.E.I.C., superintendent C.N.Ry., Port Arthur; George Blanchard, A.M.E.I.C., Fegles Construction Company, Fort William; Geo. P. Brophy, A.M.E.I.C., Public Works, Canada, Port Arthur; F. C. Graham, A.M.E.I.C., Public Utilities Commission, Port Arthur; A. G. Jeffreys, A.M.E.I.C., Port Arthur Shipbuilding Company, Port Arthur; H. M. Lewis, A.M.E.I.C., Provincial Paper Mills, Port Arthur; D. G. Calvert, A.M.E.I.C., Fort William Paper Company, Fort William; G. R. Duncan, A.M.E.I.C., G. R. Duncan and Company, Fort William; H. S. Hancock, A.M.E.I.C., Hancock and Company, Fort William; J. C. Meader A.M.E.I.C., Ontario Government road engineer, Port Arthur; E. W. Robison, A.M.E.I.C., divisional engineer, C.N.Ry., Fort William; M. W. Turner, A.M.E.I.C., Fort William Paper Company, Fort William; H. D. Booker, Jr.E.I.C., Canadian Westinghouse Company, Fort William; Elijah Cowan, S.E.I.C., Port Arthur; C. D. Jones, Fegles Construction Company, Fort William; M. W. Jennings, C.N.Ry., Port Arthur; H. R. Crowell, Provincial Paper Mills, Port Arthur; J. L. Bisson, Public Works, Canada, Fort William; C. D. Howe, C. D. Howe and Company, Port Arthur; J. W. Boughner, Public Works, Canada, Fort William; William H. Souba, C. D. Howe and Company, Port Arthur; C. J. Moors, Telephone Exchange, Fort William; A. A. Mahon, Fort William; Oscar Johnson, Port Arthur; R. J. Askin, Fort William; Douglas Urry, Port Arthur; C. B. Symes, city engineer, Fort William, and our two guests, Fraser S. Keith, M.E.I.C., general secretary of *The Institute*, Montreal, and R. L. Dobbin, M.E.I.C., superintendent of waterworks, Utilities Commission, Peterborough.

Toronto Branch

C. R. Young, M.E.I.C., Branch News-Editor.

Activities of the Toronto Branch for the coming season are taking form and a profitable series of meetings is promised. The programme committee consisting of Wm. Storrie, M.E.I.C., chairman of the Branch; George T. Clark, A.M.E.I.C., and C. R. Young, M.E.I.C., is now at

work on the selection of a series of suitable topics for the meetings.

At a meeting of the executive committee held on September 12th, the resignation of F. B. Goedike, A.M.E.I.C., as secretary was received with regret. Mr. Goedike, on account of being employed outside Toronto, has found it impossible to discharge the duties of secretary for the coming session. Overtures are being made to obtain a suitable successor for him. The acting secretary was instructed to express the appreciation of the Branch to Mr. Goedike for his services during the past year.

The matter of obtaining a new lantern for the lecture room was left in the hands of G. G. Powell, M.E.I.C., to bring to the attention of the Engineer's Club, from whom the lecture hall is rented.

The report of the Committee on Policy was received and it was arranged that the regular meeting of the Branch on October 26th, should be given over to the discussion of this report. R. O. Wynne-Roberts, M.E.I.C., was asked to lead the discussion.

The attention of the executive was drawn by H. L. Seymour, M.E.I.C., to the fact that a committee of the Ontario Legislature is to take up this fall the question of consolidation of town planning legislation and that a committee in Toronto is engaged in drafting a town planning bill to be submitted to this parliamentary committee. The Branch was requested to interest itself in the movement and to this end it was agreed that the meeting of November 15th be given up to the discussion of the draft bill. Norman D. Wilson, A.M.E.I.C., was named to arrange the details of this meeting.

Niagara Peninsula Branch

R. W. Downie, S.E.I.C., Secretary-Treasurer.

On August 16th, the members of the Branch declared a holiday and gathered with their ladies at the Queens Royal at Niagara on the Lake. In spite of the heat the tennis courts and bowling green were thronged all afternoon. The bathing beach was an even greater attraction. Dancing in the pavilion brought a happy day to a close. The members are grateful to A. W. L. Butler, A.M.E.I.C., H. L. Bucke, M.E.I.C., and O. J. McCulloch, S.E.I.C., who were responsible for organizing the affair.

The executive have laid out an attractive programme for the winter including a trip over the power tunnels of the Niagara Falls Power Company, Niagara Falls, N.Y., and dinner meetings at Welland, Niagara Falls and St. Catharines at which papers of interest will be discussed. While the Branch has lost in membership as the Chippawa power project nears completion, increased activity on the Welland ship canal and the construction work generally in the district has in a measure compensated for this loss.

The question of legislation and registration in the new professional body for Ontario, is to be discussed at a dinner meeting in Welland in October and there is no doubt but that there will be a generous response from this Branch.

Hamilton Branch

W. F. McLaren, M.E.I.C., Secretary-Treasurer.

The Hamilton Branch opened the season with a dinner at the Royal Connaught, on Friday, September 15th, 1922, at 6.15 p.m., which was participated in by a large and enthusiastic body of engineers and their friends. Hon. F. C. Biggs, Minister of Public Works, was the guest of honour. Songs were indulged in during the evening, a verse being added to the song, "Old Macdonald had a Farm", the new words being:

> Old man Biggs built a highway,
> And on this highway he put a sign;
> "A detour here and a detour there
> And here a detour, there a detour,
> Here and there a detour".

Niagara Peninsula Branch Outing at Niagara-on-the-Lake.

"Next year," said Mr. Biggs, "I shall eliminate that word "detour", and simply say, "Development — this way around".

F. W. Paulin, A.M.E.I.C., was chairman, and stated that our meeting would be short to allow the engineers to hear the debate between J. H. Duthie, secretary of the National Waterways Association of Canada, and Senator George Lynch-Staunton of this city.

T. J. Mahony, of the Suburban Highways Commission made a brief address, and then Mr. Biggs took the floor, being welcomed with the singing of "He's a Jolly Good Fellow". The speaker stated that he had outlined and was consummating a scheme of highways which followed the old pioneer roads and which would touch every county and every county town in Ontario, and in which 90 per cent of the population live. In all there would be 1,824 miles of paved highway. The work was all being done by trained engineers presided over by a chief, who had three assistants, each supervising about 600 miles of roadway. These had other engineers under them and if a report was wanted on any section he could get it in an hour by telegraphing the engineer on that section. Ninety per cent of the engineers were returned men and even the inspectors were graduate engineers. He referred to the difficulties encountered in entering Hamilton from the west, where the five bridges had been built. The city was to pay 40 per cent, but insisted on paying $365,000 and no more. As the 40 per cent would have been $268,000, the city lost out on this deal.

Other difficult features met with were at "Clappison's cut" which was 1,400 feet long and 53 feet deep costing $138,000; the Ancaster road up the mountain, 30 feet wide, of which 20 feet would be paved and 10 feet macadam for horse traffic; the "Binkley subway" requiring 48,600 yards of excavation; Dundas street started in 1921, on which good headway had been made and a magnificent concrete bridge built over the Sixteen-mile creek. He referred to the bridge across the canal at Hamilton Beach as a big blunder because it was so narrow that it would have to be replaced in three years. Mr. Biggs referred to a bill he had introduced in the Ontario house for the "Capitalization of Motor Licenses". This will provide $2,000,000 a year, which will not only retire the debenture interest but will wipe out the capital cost of the highways in twenty years. The floating of new loans to wipe out old loans was poor financing and under the new bill this will not be necessary.

He stated that there were only twenty-three trucks in Ontario over five tons capacity and only one per cent over three tons. It is these heavy trucks that injure the roadway and one per cent of the traffic cannot be allowed to damage these expensive highways. From August 15th every truck has to carry a sign showing its capacity in tons. Inspectors are being sent out to watch these and any truck exceeding its limit will be required to immediately unload and will be prosecuted as well. Two trucks equipped with "loading meters" are being used for this purpose and if necessary more trucks will be employed on this duty. He referred to the congestion of traffic at Bridgeburg where he was recently help up by the traffic which was stalled for seven blocks. He was told he might get across in four hours but he preferred to go round by Niagara Falls. A bridge must be built there for the hundreds of thousands seeking to cross the Niagara river at this point.

The meeting closed with loud applause and a hearty vote of thanks to the Minister for his very instructive address.

Ottawa Branch

F. C. C. Lynch, Associate E.I.C., Secretary-Treasurer.

The following officers of the Dominion Government have been in attendance at the Eighth National Exposition of Chemical Industries, held in the Grand Central Palace, New York, during the week of September 11th, — F. G. Wait, chemist, Department of Mines; A. M. Beale, A.M.E.I.C., Dominion Water Power Branch; W. B. Stokes of the Dominion Forestry Service.

An important conference in the Lake of the Woods regulation matter took place in the office of the Prime Minister on September 20th, when Governor Preus of Minnesota, made certain representations regarding the attitude of his State. Governor Preus is a strong advocate of the early commencement of the St. Lawrence navigation and power project, which formed the subject matter of his address before the Empire Club in Toronto recently.

A distinguished visitor in Ottawa this week was Dr. W. H. Eccles, D.Sc., A.R.C.S., F.R.S., M.I.E.E., Dean of the University of London, vice president of the I.E.E., of the Physical Society and of the Institute of Physics, and vice chairman of the British Wireless Telegraph Commission. Whilst in Ottawa Dr. Eccles was entertained by the radio members of the Branch. The shortness of his stay rendered it impracticable to arrange for a luncheon or an address to the Branch.

With the establishment of the Department of Defence, the Department of the Naval Service disappears and the Hydrographic, Tidal Service and Radiotelegraph branches of the Naval Department have been transferred, together with all personnel and activities, to the Department of Marine and Fisheries.

A. M. Narraway, S.E.I.C., D.L.S., controller of surveys, has returned to Ottawa after completing a most successful and interesting trip through western Canada in connection with the supervision of the surveys of the Topographical Surveys Branch. His trip included a thousand-mile seaplane flight from Victoria Beach, north of Winnipeg, to a point about two hundred miles northeasterly on the Manitoba-Ontario boundary where he visited the camp of J. W. Pierce, A.M.E.I.C., D.L.S., at present engaged upon making this boundary survey, and thence across country to The Pas, Manitoba, and northwesterly to the camp of E. P. Bowman, A.M.E.I.C., D.L.S., engaged upon control traverse surveys. In addition to this, reconnaissance flights were made over a portion of the Manitoba-Ontario boundary yet to be surveyed and over the Churchill and Reindeer rivers. Mr. Narraway speaks very highly of the efficiency of the officials of the Air Board who arranged

and conducted the flight and the good work in forestry air patrol by officials of the Forestry Branch. In addition to the above Mr. Narraway visited the party engaged on the survey of the Alberta-British Columbia boundary, southwest of the Grande Prairie district, as well as a number of parties on the prairies in Saskatchewan and Alberta.

Lt. Col. L. T. Martin, D.S.O., M.E.I.C., was married on the 12th September to Miss Frances Kathleen Heney, of Ottawa. Col. Martin who is well known throughout Ontario is one of the Commissioners of the T. & N.O. Ry., and commanded the 7th Battalion Canadian Railway Troops for the greater part of the war in France. After a two weeks trip through the Adirondacks and the White Mountains Mr. and Mrs. Martin will take up residence in Ottawa.

Cape Breton Branch

Kenneth G. Cameron, A.M.E.I.C., Secretary-Treasurer.

The opening meeting of the winter session of the Cape Breton Branch was held in the Branch rooms on September 12th.

The Branch chairman, C. M. Odell, M.E.I.C., presided, and K. H. Marsh, M.E.I.C., chief engineer of the Dominion Iron and Steel Company, presented a most instructive and interesting paper dealing with the construction and operation of the blast furnace. He traced the development of the present day furnace from the early variety known as the Catalan forge through the various stages of increased height and hearth, with the introduction of the hot blast, the closed top, with the utilization of the waste gases.

Following a description of the various chemical reactions taking place between the materials of the burden during their descent through the stack, Mr. Marsh outlined the various difficulties which have arisen, and the manner in which they have been overcome. Many ideas have been, and are constantly being incorporated into the construction with a view to eliminating troubles and obtaining a better product with a smaller consumption of fuel. Mr. Marsh illustrated his paper with diagrams and photographs showing the different types, both past and present, and at the close of his paper answered numerous questions arising from the general discussion which took place.

In closing, the chairman extended the thanks of the members to the speaker for the trouble he had taken in the preparation and presentation of his paper.

Montreal Branch

E. A. Ryan, A.M.E.I.C., Secretary-Treasurer.

At a meeting of the Executive Committee held on August 3rd, Mr. Farmer submitted a report of an informal meeting with representatives of the American Society of Mechanical Engineers concerning the Spring meeting of that society which is to take place at Montreal in 1923. A special committee composed of Messrs J. A. Duchastel, George MacLeod and Fraser S. Keith, was appointed as representatives of *The Engineering Institute of Canada*, to co-operate with the local Meetings Committee of the A.S.M.E.

The chairman also read a letter from the secretary, J. L. Busfield, M.E.I.C., intimating that on account of his professional duties in connection with the Hydro-Electric Inquiry Commission of Ontario, necessitating an absence from Montreal of considerable duration, he felt it necessary to tender his resignation as secretary of the Branch. General regret was expressed at the need of accepting Mr. Busfield's resignation and in doing so the Executive Committee placed on record its "appreciation of the signal services rendered by Mr. Busfield during several years of increasing activity, to which his energy, initiative and untiring devotion to the duties of his office and to the interests of the E.I.C., were large contributing factors".

The Executive Committee held another meeting on August 31st, at which the new secretary-treasurer, E. A. Ryan, A.M.E.I.C., was appointed. His address is Room 703, Southam Building, 128 Bleury Street, to which communications for the Montreal Branch should be henceforth forwarded.

Saskatchewan Branch holds Summer Meeting at Moose Jaw, Sask.

1 W. A. Begg	11 H. J. A. Bird	21 A. E. Hamilton	31 W. H. Greene	41 W. L. Campkin
2 D. C. M. Davies	12 R. W. Allen	22 H. A. McLean	32 J. R. C. Macredie	42 R. F. Tilsley
3 D. A. Smith	13 J. N. deStein	23 F. B. Reilly	33 C. J. MacKenzie	43 J. Peters
4 T. W. Brown	14 C. E. Malone	24 J. B. Parker	34 Prof. G. M. Williams	44 R. W. E. Loucks
5 O. W. Martyn	15 K. McKenzie	25 C. R. Bennetton	35 C. S. Moss	45 R. N. Blackburn
6 G. D. Mackie	16 J. W. D. Farrell	26 W. J. Jones	36 W. E. Longworthy	46 E. A. Duschak
7 G. H. Whitlock	17 T. McGuinness	27 M. Sinclair	37 D. A. R. McCannel	47 A. E. Kehoe
8 L. A. Thornton	18 A. W. Paterson	28 A. P. Linton	38 C. Houlton Davis	48 W. A. Hillman
9 A. Ferguson	19 H. S. Carpenter	29 D. W. Houston	39 P. W. Graham	
10 J. McD. Patton	20 A. Edmonds	30 A. C. Garner	40 G. G. Fitzgerald	

OTHER SOCIETIES NEWS

Federated American Engineering Societies

The Bulletin of the F.A.E.S.

The first number of the new "Bulletin" of the F.A.E.S., was issued September 1st, 1922, and replaces the mimeographed bulletin, which has been distributed by the organization since the commencement of its work. The first issue is a credit to those responsible for its production, and provides eight pages of current news of interest to the members of the engineering organization which are members of the F.A.E.S. The purpose and policy of the Bulletin are set forth in the closing paragraph of an editorial in the first number, which is as follows:—

"From the formation of the Federated American Engineering Societies, three principles have guided its publicity work:

(1) All matter sent out must be informative and expository — never argumentative.

(2) No propaganda material can be permitted.

(3) No matter aggrandizing the Federated American Engineering Societies or any persons connected therewith can be permitted.

These three principles will be strictly applied in the publication of the Bulletin.

The ever-present purpose shall be to produce a publication worthy of 'an organization dedicated to the community, state and nation' and dealing with matters of 'public welfare wherever technical knowledge and engineering experience are involved'."

Representatives at International Congress

The Federated American Engineering Societies designated the following engineers as its representatives at the International Engineering Congress, which was held at Rio de Janeiro in connection with the Brazilian Centennial. V. L. Havens, editor Ingeniera Internacional, New York City; F. J. W. Luck, representative of F. H. Walker & Company, Rio de Janeiro, Brazil; Thomas T. Read, Bureau of Mines, Department of the Interior, Washington, D.C., Calvin W. Rice, secretary, the American Society of Mechanical Engineers, New York City. The congress opened on September 7th and lasted throughout the month.

American Society of Civil Engineers Appoints Secretary

At a recent meeting of the Board of Direction of the American Society of Civil Engineers, John Hoffman Dunlap, M. Am. Soc. C.E., professor of hydraulics and of sanitary engineering in the College of Applied Science, State University of Iowa, was appointed secretary, this office having been filled temporarily for a year past by Elbert M. Chandler, to whom a vote of thanks was tendered for his faithful and able services as acting secretary during a difficult period. Mr. Dunlap was born at Harrisville, N.H., on September 9th, 1882, is a graduate in Arts from Dartmouth College, and received the degree fo C.E. from Thayer School of Civil Engineering in 1908. On graduation Mr. Dunlap was appointed field instructor at the Thayer School and the next year he was advanced from instructor to associate professor of hydraulics and sanitary engineering and later professor of hydraulics and sanitary engineering, College of Applied Science, State University of Iowa, which position he occupied until his recent appointment. Since 1915, Mr. Dunlap, in addition to his professional work, has carried on a general practice as civil and sanitary engineer, acting for the Iowa State Board of Control and for the Iowa State Board of Health. Since 1913 Mr. Dunlap has been a prolific contributor to engineering literature, particularly in connection with sewage and water supply, but has also found time to take an active interest in engineering welfare as shown by his paper before the S.P.E.E. on "Co-operation between Engineering Societies and Educators in Standardizing Engineering Education". Besides being a member of the Amer. Soc. C.E. his membership includes S.P.E.E., New England Water Works Assn., Amer. Water Works Assn., Amer. Public Health Assn., Proportional Representation League, Thayer S. Engrs. and I. Eng. S., N.J. Mr. Dunlap is president of the Social Service League of Iowa City and a member of the executive committee, Boy Scout Council, Iowa City, and also a member of Gamma Alpha, Phi Beta Kappa, Sigma XI, the Triangle Club and the Progressive Republican.

American Electrochemical Society

Annual Fall Convention in Montreal

The annual Fall Convention of the American Electrochemical Society was held in Montreal, September 21st to 23rd, with headquarters at the Windsor Hotel. An invitation to participate in the various functions was extended to all members of *The Institute* in Montreal. Scientists of pre-eminence in the domain of electrochemistry of North America, to the number of two hundred, were in attendance, including among others the following:

Carl G. Schluederberg, assistant manager of the Westinghouse Company, Pittsburgh, who is the president of the society; Professor Wilder D. Bancroft, of Cornell University, Ithaca, N.Y., Robert Turnbill, manager of the U.S. Ferro Alloys, Niagara Falls, N.Y.; F. A. J. Fitzgerald, consulting engineer and electric furnace expert, of Niagara Falls, N.Y.; Acheson Smith, vice-president and general manager of the Acheson Graphic Co., Niagara Falls, N.Y.; J. V. N. Dorr, president of the Dorr Company, New York and London; H. M. Williams, chief metallurgist of General Motors, Dayton, Ohio; H. W. Matheson, vice-president Canadian Electro Products, Shawinigan Falls. J. A. Matthews, president of the Crucible Steel Co., New York; E. L. Crosby, president of the Detroit Electric Furnace Co.; Professor Lash Miller of Toronto University, considered one of the leading authorities of the present day on electro-chemical matters; Wirt S. Scott, manager of the industrial heating section of the Westinghouse Company, Pittsburgh; Prof. M. A. Hunter, of Rensselaer Polytechnical Institute, and director of research for the Driver-Harris Co.; Prof. Alexander Lowy, of the University of Pittsburgh.

The programme for the three days session, besides providing a number of enjoyable social features, included many papers of current interest.

Geodetic Society

The Geodetic Survey of Canada, of which Noel J. Ogilvie, M.E.I.C., is superintendent, has among its engineers a large number of members of *The Engineering Institute.* The work of the survey extends from coast to coast and no better idea of the extent of this work, nor of the fellowship existing among the members of the staff of the survey, can be obtained than through the pages of a small publication issued by the staff of the survey entitled, "News Letters of the Geodetic Survey of Canada". In a recent issue of this publication are a number of very interesting letters describing the work of various engineers in the field, among which are contributions from the following members of *The Institute:*—Hazen P. Moulton, A.M.E.I.C., who is this year on precise levelling in Nova Scotia, having commenced in the neighbourhood of Port Hawkesbury; D. McMillan, A.M.E.I.C., on precise levelling around the Bay of Fundy; Claude H. Brabazon, A.M.E.I.C., on triangulation in the neighbourhood of Magdalene Island; W. C. Murdie, A.M.E.I.C., in charge of triangulation work in the lower St. Lawrence; J. W. Menzies, A.M.E.I.C., on secondary triangulation work in the Saguenay district; H. G. Rose, S.E.I.C., on reconnaissance work in the neighbourhood of the Bay of Chaleur; George F. Dalton, A.M.E.I.C., in charge of precise levelling in the Northern Ontario district; D. J. Fraser, A.M.E.I.C., at Union Bay, B.C.; N. H. F. Smith, Jr.E.I.C., on precise level work, Sicamous, B.C.; G. H. McCallum, A.M.E.I.C., on triangulation work at Namu, B.C.

A Course of Industrial Metallography

Under the auspices of the Department of Metallurgy of McGill University an extension course in Metallography will be given as in previous years, by Messrs. Harold J. Roast, F.C.S., F.C.I.C., and Charles F. Pascoe, F.C.I.C.

The course consists of fifteen periods, held on Monday nights at the Chemistry and Mining building McGill University, commencing on Monday, November the sixth at 8.00 p.m.

Application should be made to either of the lecturers, their address being McGill University, Department of Metallurgy. The fee for the course is $20.00 payable to the Bursar. In as much as only twelve members can be accommodated at one time, students will be enrolled in order of their applications.

In past years the class has been composed of mechanics, engineers, chemists and those desiring a winter hobby, or whose business brings them in contact with metals and who desire to have more knowledge of their composition. *No previous knowledge is assumed* and the course is essentially practical from first to last. If any students from a previous year desire to continue their work provision will made for an advanced course if sufficient members are obtained.

Ferrous and non-ferrous metals are dealt with equally, training being given in preparing them for examination under the microscope, and finally photographing the various structures developed.

CORRESPONDENCE

Stewart & McDonnell,
Gold Coast Harbours
Seccondee, Gold Coast Colony.
August 19th, 1922.

Editor, *Journal:*—

Dear Sir:—

As I have not received any communications from *The Institute* for some considerable time I would like to draw your attention to the change in my address.

Associated with me here are Majors Crysdale and Silcox and at present we are all engaged on the preliminary work for the construction of a harbour at Takoradi, about six miles from Seccondee. The work is very interesting and novel and the methods of labour so far have been entirely new to us. To date the grading for temporary and service lines of railway have all been done by local labour. All the material has been moved by baskets and head work, and the grading has been remarkably well done, although it has required careful supervision.

By the time you receive this, steel will be at the site of the proposed harbour, and arrangements for the commencement of the protection works will be started.

At a later date I shall be very glad to give any further details of this Canadian enterprise should you desire it.

With kindest regards, I remain,

Yours truly,

A. G. GRAHAM, A.M.E.I.C

A. G. Graham, A.M.E.I.C. Major Augus Stewart, A.M.E.I.C. Col. McDonald S. C. Arnett Major C. R. Crysdale, M.E.I.C.

Canadians on Harbor Construction at Gold Coast Harbours, in Africa.

Preliminary Notice

of Applications for Admission and for Transfer

20th July, 1922

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in August, 1922.

FRASER S. KEITH, Secretary.

*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option, Railway, Municipal, Hydraulic, Mechanical, Mining or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects. Geography, History (that of Canada in particular), Arithmetic, Geometry, Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits scientific acquirements ,or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge

The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

APPLETON—ALBERT THOMAS, of 711, Banning Street, Winnipeg, Man Born at Hamilton, Ont., Sept. 12th, 1883; 1905-09, operating, Dominion Power and Transmission Co.; 1909, chief electrician in chg. Port Colborne Cement Plant; 1910, asst. electrician in the installing of the electrical equip'mt., Oliver Chilled Plow Works, Hamilton, Ont.; 1911, install'n. of terminal station for Canadian Westinghouse Co., Winnipeg; Oct. 1911, chief operator in chg. of sub-stations and from 1912 to date, supt. of stations, City of Winnipeg Hydro Electric System.

References: E. V. Caton, C. A. Clendening, G. L. Guy, J. G. Glassco, C. F. Gray, J. Rocchetti.

ARMSTRONG—DOUGLAS BOND, of 225 Addington Ave., Montreal. Born at Westmount, Que., Dec. 25th, 1892. Educ., 1912-15, civil engr'g., McGill Univ.; 1909-12, dftsman and checker, Dominion Bridge Co., Lachine, Que.; 1918-19, Adjutant Engr., Training Depot, St. Johns, Que.; 1919 to present, design'g. office, Dominion Bridge Co., Lachine, Que.

References: F. P. Shearwood, P. L. Pratley, D. C. Tennant, F. Newell, A. S. Wall.

HATTON—GERALD PERCY, of Calgary, Alta. Born at Cork, Ireland, Feb. 26th, 1871. Educ., B.A., and B.E., Royal Univ. of Ireland 1892 and 1893; 1894, post graduate course in civil engr'g., and asst. lecturer to Prof. Alex. Jack, M.A., C.E., 1890-91, constrn. of Youghal Waterworks under S. A. Kirby, M.A., C.E.; in chg. of constrn., of Cork and Passage Rly., Kanturk and Newmarket Rly., Schull and Shibreen Light Railway under Mr. R. T. Perry, C.E.; 1895-96, prelim. surveys and estimates for Queenstown waterworks; 1896, Youghal waterworks and 1897, extension of Cork and Passage Rly. to Crosshaven; 1898-99, constrn. Queenstown waterworks including constrn. of reservoir dam, 1911-13, chg. of 6 foot main trunk sewer in East Calgary till its completion under J. T. Child, C.E.; worked for firm of Jarie Bros., Boomer and Hughes on elevator constrn.; enlisted 137th batt. C.E.F., until 1916, served on western front with 49th batt. C.E.F., and discharged 1919; at present engr'g. clerk, levelling office of Topographical Surveys Branch, Dept. of the Interior, Calgary, Alta.

References: C. G. Child, J. A. Spreckley, C. Chambers, R. H. Montgomery, A. Fraser, H. E. Read, F. K. Beach.

NIXON—NORMAN JAMES, of 7173 Sherbrooke Str., W., Montreal, Que. Born at Vankleek Hill, Ont., Sept. 7th, 1890; Educ., B.Sc., Queen's Univ., 1915; student shop course, Northern Electric Co., Montreal; 1915-16, switchman, Regina Automatic Exchange. Sask. Govt. Telephones; 1916 (Feb.-July), sales engr., Northern Electric Co., Regina, Sask., 1916-20, Canadian Westinghouse Engineering Office, Hamilton. Ont., from 1917-20, section leader, in chg. of control apparatus design; May 1920 to date, foreman engr., on power installn., and telephones, Northern Electric Co., Ltd., Montreal, Que.

References: H. B. Dwight, W. F. McLaren, J. B. Stirling, W. L. Dawson, C. W. Burroughs, A. Macphail, D. S. Ellis, C. V. Putman, A. E. MacRae.

STRAIN—JOHN WALKER, of 5381 Vancouver Ave., Detroit, Mich. Born at Glasgow, Scotland, Mar. 28th, 1889; Educ., grad. Normal Seminary, Glasgow; 5 yrs. app'tceship., structr'l. engr., drawing office and workshop training; 2½ yrs. works engr., in chg. building constrn. and plant mtce., Nobels Explosives Co., in Pembrey Factory, South Wales; 3 yrs. works engr., chg. constrn. and mtce. of plants, Chance and Hunt Ltd., explosive mfrs., Birmingham, England; engr. with Albert Kahn, Archt., Detroit, on struct'l. design and as building supt., on the new Burroughs plant, Windsor, and New Fisher Body Factory, Cleveland; later employed as mgr., R. Westcott Co., Ltd., bldg. contrs., Windsor; at present, building contractor, partner of the firm of Strain and Emery, Ltd., Windsor, Ont.

References: Alex. Bowman, A. J. Riddell, O. J. Hein, H. C. McMordie, F. H. Kester.

SOUBA—WILLIAM HENRY, of 706, Whalen Bldg., Port Arthur, Ont. Born at Hopkins, Minnesota, U.S.A. Educ., M.E., Minnesota Univ., '09; 1901-08, mech. dftsman., Minneapolis Threshing Machine Co., Hopkins, Minn.; 1909-10, dftsman., Williamson and Merchant Patent Attorneys, Minneapolis; 1910-14, mech. dftsman and designer on grain elevator work with Barnard and Record, Co., Minneapolis, Minnesota to 1912, and Barnett-McQueen Co., Ltd., Fort William, Ont., to 1914; 1914-15, asst. engr., Board of Grain Commissioners for Canada, on grain elevator work at Saskatoon, Calgary and Vancouver; 1916-17, same work at Regina, Sask. and Port Arthur, Ont.; 1917 to date, partner with C. D. Howe & Co., consltg. engrs., Port Arthur, Ont.

References: J. Antonisen, W. T. Moodie, F. C. Graham, G. Blanchard, F. Y. Harcourt, H. M. Lewis, R. B. Chandler.

WARNER—DONALD FRANKLIN, of 10, Elsmere Ave., East Lynn, Mass. Born at Halifax, N.S., June 14th, 1898. Educ., S.B., Mass. Inst. of Technology '22; 1916-19, science study, Dalhousie Univ., Halifax, N.S.; 1918 (summer), dftsman., Public Works, Ottawa; 1919, instrctr., in drawing and decipher geometry, Dalhousie; 1920, dftsman. and instr'man., Prov. Highways Board, Halifax; to date, turbine circulator, General Electric Co., West Lynn, Mass.

References: J. N. Finlayson, W. P. Morrison, J. W. Roland, C. E. W. Dodwell, L. H. Wheaton, I. P. MacNab, R. C. Moore.

WHITEHILL—PETER, of 301, Inkster Blvd., Winnipeg, Man. Born at Paisley, Scotland, Aug. 1897; Educ., B.Sc., (C.E.), Univ. of Manitoba, '21; 1917 (summer) Hudson Bay Rly.; 1919, topog'r., Canadian Nat. Rly. location; 1920, good roads engr.; 1921 (May-June), asst. distr. engr., Good Roads Board of Manitoba; 1922 (summer) inspector on reinforced concrete culvert work under Good Roads Act.

References: D. L. McLean, J. N. Finlayson, W. H. Hunt, M. A. Lyons, R. W. Moffatt.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

[illegible]

References: [illegible]

[illegible]

References: [illegible] C. H. Fox, [illegible]

[illegible]

References: W. [illegible], W. B. Dawson, [illegible] Keith, J. G. G. Kerry, G. G. Gale.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

MACKENZIE—GORDON LESLIE, of [illegible] Canada Bldg., Saskatoon, Sas[k]. Born at [illegible], Feb. 22nd, [illegible]. Educ. B.Sc., C.E., Queen's Univ., (honour[s]) [illegible] D.L.S., previous to univ. course; [illegible] summer, i/c chg. su[rvey] and [illegible] work for Grasselli Chemical Co. of Cleveland at their Mining proper[ty] at [illegible], Ont.; [illegible] asst. on D.L.S., Dept. of Indian Affai[rs]; [illegible] Feb.-May, Bridge Dept., C.P.R., Montreal; [illegible] to date, associated with J. [illegible] [illegible] engr., [illegible], drainage and highways work for municipalit[ies] and municipal improvements for local towns.

References: J. E. Underwood, R. A. McLellan, E. P. Johnston, D. Chene, E. Stone, R. A. Garvie, J. E. Harvey.

WHITTIER—ALBERT RONALD, of Ottawa, Ont. Born at Ottawa, On[t.], [illegible] 1891. Educ., B.Sc., Queen's Univ., '20; 1916, summer, dftsman. and on ou[tside] work for J. B. McRae, [illegible] engr., Ottawa; 1917, summer, asst. peat surv[ey], [illegible] of Mines, Ottawa; 1918-19, Lieut., Can. Engrs., instructor in maths., Khaki Un[iv.] [illegible], England. [illegible] tutor at Queen's Univ. for the season after return; 1920-[21] [illegible] Dominion Bridge Co., Lachine; Aug. 1921 to date, asst. [illegible] engr. on Rideau Canal, Ottawa.

References: A. T. Phillips, E. B. Jost, A. Peden, A. K. Hay, W. P. Wilgar, J. McRae, A. Macphail.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

JOHNSON—G. ALAN, of 4[illegible] Sherbrooke St. W., Montreal, Que. Bo[rn] at Ottawa, Ont., Nov. [illegible], 18[illegible]. Educ., B.Sc., McGill Univ., '12; July 1912-Apr. 19[13], [illegible] 1913, Feb.-Aug., [illegible] and design hydro-electric power developments for J. [B.] McRae, Ottawa; Apr. 1913 to Feb. 1914, res. engr., for J. B. McRae on constrn. of d[am] and [illegible] at High Falls on the Lievre River near Buckingham; 1914-15, res. m[gr.] for the [illegible] Hydraulic Constrn. Co., on storage dam built for the H.E.P. of Ont., at [illegible] Falls; 1917, Mar.-Dec., equipping and mfg. shell parts, gaug[es], etc., Robert Mitchell Co., Ltd.; 1918-18, Lieut., Can. Engrs.; Mar. 1918 to da[te], factory mgr., Robt. Mitchell Co., Ltd., Montreal.

References: J. B. McRae, R. J. Durley, R. A. C. Henry, W. S. Lea, G. L. Matt[hews], W. P. Wilgar, J. H. McLaren, A. C. Wright, H. L. Trotter.

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ENGINEERING JOURNAL

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OF CANADA

NOVEMBER 1922 Volume V, No. 11

CONTENTS

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BRANCHES:

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Cape Breton Branch, Sydney, Cape Breton.
Moncton Branch, Moncton, N.B.
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Peterborough Branch, Peterborough, Ont.
Toronto Branch, Toronto, Ont.
Hamilton Branch, Hamilton, Ont.
Niagara Peninsula Branch, Niagara Falls, Ont.
London Branch, London, Ont.
Border Cities Branch, Windsor, Ont.
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Lakehead Branch, Port Arthur, Ont.
Winnipeg Branch, Winnipeg, Man.
Saskatchewan Branch, Regina, Sask.
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Principles and Practices for the Valuation of Public Utilities

Some Important Considerations entering into Various Methods of Valuating.

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Valuation implies the ascertainment of the "value" or worth of a thing. Value is defined in the Standard dictionary as the "desirability or worth of a thing as compared with the desirability of something else"; it is a term, however, which has been used rather loosely and has been aptly described as one of the most uncertain words in the dictionary of economics.

The valuation or appraisal of public utilities is by no means a new idea, in fact it dates back to the inception of the public utility. The earliest railway laws of some European countries, notably Germany, Switzerland and France, contained provisions for the purchase of railways by the State upon various bases of valuation. In America the idea is also as old as the public utility. The industrial and economic development which has taken place during the last thirty years has brought about a relationship between the public and public utility corporations which has become very complex, and amongst the various questions entering into this relationship not the least important has been that involving the valuation or appraisal of these public utilities.

This question began to attract the attention of the engineering profession in North America to some considerable extent about 1900 and has since that date developed into quite an important branch of the profession.

Purpose

The valuation of public utilities may be undertaken for a number of purposes, among which might be mentioned the following:—

General public information. — A government or state may desire to obtain some information as to the relative value of various utilities for its general information, a good example being the valuation of railway properties in the United States for the Census Bureau in 1904 and 1905, which was done by Prof. Meyer of the University of Wisconsin. A description of this valuation will be found in Bulletin No. 21 issued by the Department of Commerce and Labour, Bureau of Census and entitled "Commercial Valuation of Railway Operating Property in the United States 1904." Another example of this is the valuation of the Canadian Northern and Grand Trunk Pacific Railways made by Prof. Swain for the Royal Commission appointed in 1916 to inquire into railways and transportation in Canada.

Taxation. — A governing body having the power to tax may desire to ascertain the relative value of utilities under its jurisdiction for the purpose of establishing a basis for taxation. An example of this may be found in the valuation of the railways in Michigan undertaken in 1900 by the Board of State Tax Commissioners, the actual valuation being under the direction of Professor Cooley, Dean of the Department of Engineering, assisted by Prof. Henry Earle Riggs who gave a lengthy description of the valuation in a paper before the American Society of Civil Engineers on January 4th, 1911. This paper appears in the "Transactions of the American Society of Civil Engineers" as Paper No. 1190.

Limiting capitalization. — A public service commission may desire to exercise control over the capitalization of a public utility for the purpose of protecting the public against loss of investment due to the over capitalization of the utility, and in order to do so, must ascertain the value of the utility. Examples of this may be found in the valuations made under the Stock and Bond Law of Texas passed in 1893 and also in the valuations now under way by the Interstate Commerce Commission.

Rate making. — Probably the best example of this is the valuation of the railways of the United States undertaken by the Interstate Commerce Commission under the provisions of Section 19A of the Interstate Commerce Act 1914. This valuation has not yet been completed.

Several of the state commissions have also had valuations made for purposes of taxation or rate making.

Expropriation. — Good examples of this are the expropriation by the Dominion Government of the Carslake hotel property at Montreal and the Halifax dry dock at Halifax. A noted case in the United States is the expropriation of the Maine Water Company known as the Kennebec Water District case.

Sale or purchase. — Many railways in Canada and the United States have been purchased and sold on some basis of valuation.

Underwriting securities. — It is not an uncommon practice for bankers to make valuation of public utility properties in connection with the underwriting of securities.

Sharing facilities. — Public service corporations very frequently enter into joint facility contracts which usually necessitate the valuation of the facilities to be used jointly.

Reorganization. — Valuations are often undertaken in cases of the reorganization of public service corporations which have got into difficulties from one cause or another or for the purpose of arriving at a basis of establishing the relative value of the securities of two utilities which it is intended to consolidate under a consolidation or reorganization scheme.

Practices and Principles

Many persons are of the opinion that the value of a public utility established by appraisal should be the same regardless of the purpose for which the appraisal is actually undertaken, in fact, it has been suggested that it would probably be better if the person making the appraisal were ignorant of purpose for which it was to be made. However this may be, the practices and principles governing the valuation or appraisal of public utilities have varied very widely in the past and undoubtedly have been influenced to a very great extent by the purpose for which the valuation was undertaken, by the time available, by agreements which may have been made between the interested parties laying down the principles to govern in particular cases, and by the judgments given in previous cases of a similar character by the courts.

In any given case the questions at once arise as to how the value is to be ascertained, as to what the test of value is to be and as to what factors should be taken into account in establishing value. In general, it may be said that all elements affecting value should be given due consideration and proper weight. Some of the principal bases used in ascertaining or testing value are described below.

Capitalization of Net Earnings

The early railway laws of Prussia made provision for the purchase of any railway and all its property at a fair value, such value to be determined upon the basis of the net earnings for a period preceding the date of acquisition. The actual purchase of Prussian railways by the state, however, was not done on this basis, but upon the basis of facts presented with respect to the results of operation for a period of years, the condition and earning capacity at the time of purchase and the potentialities of the property.

Professor Meyer in the commercial valuation of railways in the United States for the Bureau of Census applied this method, as the time at his disposal was brief and his valuation was intended to give a rough idea of the commercial value of the railways. His method was to capitalize the average net earnings for a period of five years; in cases of recently constructed roads, the cost of construction and equipment was used; in the case of roads whose sources of traffic would be exhausted within a determinable period, the scrap value was taken as the base, to which was added an allowance corresponding to the probable length of time during which revenues could be earned; in the case of roads having no earnings, or prospect of earnings, the scrap value was taken.

A valuation made on the basis of the capitalization of net earnings over a period of years, usually involves a detailed study of the accounts of the public utility during the period under review to ascertain the practices which have been adopted; and very often it is necessary for various reasons to recast the accounts entirely before a true picture of the net earnings for the period chosen can be presented.

An analysis of the accounts may show that no provision has been made for depreciation; that operating expenses have been charged to capital account; that additions and betterments have been charged to operating expenses; that bad debts have not been written off; that credit has been taken for interest on advances and loans when no interest has been collected or is collectible; or that improper material stock adjustments have been made.

It is also necessary to examine the physical property to see if it has been properly maintained and developed, as these factors have a bearing on the net earnings. If the valuation is being made by a prospective purchaser as a commercial proposition, that purchaser is primarily interested in what return he can reasonably expect on his money, consequently the net earnings, present and prospective, are the principal measure of the value of the property to him. If, on the other hand, the valuation is to ascertain what shall be a fair rate to allow for service, it can be readily seen that the capitalization of net earnings would simply involve reasoning in a circle.

Analysis of Market Quotations of Stocks and Bonds

A very common method of valuing the property of public utility corporations by bankers, financiers and commercial interests for purposes of the purchase of securities, the underwriting of securities or the purchase of the physical properties of corporations, is by what is known as the stock and bond method, which consists in reviewing the market quotations of the stocks and bonds of the utility for a period of years and basing judgment as to value on these market quotations. This method is considered in some quarters as a very accurate one, as the prices established on the exchange are supposed to represent the resultant of a combination of the judgments of a very large number of individuals.

An analysis of market quotations of stocks and bonds would necessarily have to be supplemented by an examination of the rights, franchises, physical condition of the property and the accounting methods adopted by

the utility in showing the results of operations, otherwise any judgment as to value, established solely by an analysis of stock and bond quotations, might be very far from the actual value.

A great many public utilities, however, would not be susceptible to a valuation on this basis, as the securities may not be quoted on the stock exchange at all, or if quoted on the exchange, are held by a limited number of persons, so that actual transactions are so few in number as to render it very difficult to base, on such sales, any judgment as to value.

Analysis of Original Cost to Date

This means that an analysis must be made to ascertain the original cost of the items of physical property of the public utility at time of construction, to which must be added additions and betterments properly chargeable to capital account, made from date of construction to date of review, and from which must be deducted all items retired or disposed of. It is also necessary to ascertain the actual cost of other items not of a physical character entering into the development of a public utility, amongst which might be mentioned the following: Promotion expenses; expenses of preliminary investigations, securing charter rights, franchises, and financing; organization expenses; overhead expenses during construction, including legal expenses, expenses of engineering and supervision, taxes and insurance, interest during construction, other general administration expenses; development expenses in building up the business from a 'bare bones' state to a 'going concern'.

The analysis of the actual cost of the various items mentioned above usually involves: The preparation of a detailed inventory, properly classified, of all items making up the physical property as of the date of valuation; a thorough analysis of the records and accounts of the utility to ascertain the actual cost of the physical items included in the inventory, as well as of all other items which may properly be included as part of the cost.

The work necessary and the extent to which the actual cost can be ascertained depends entirely upon the nature of the records and accounts which are available. The records and accounts may be such that the original cost to date can be ascertained quite readily; they may be such that the original cost can be ascertained, but not without a partial or entire recasting of the operating accounts from the date of operation; and they may be such that the original cost cannot be ascertained at all.

After the original cost to date has been ascertained it becomes a question of finding the relation between cost and value. This involves consideration of the physical condition of the property, operating results over a period, franchise or other rights, other intangible elements of value, and potentialities of property.

Estimating Cost of Reproduction New and Cost of Reproduction New less Depreciation

Estimating the cost of reproduction new is a practice which has been resorted to, partly because of the impossibility in a great many cases of obtaining records which disclosed the actual cost and, partly for the purpose of taking account of any increment in value subsequent to date of construction caused by the development of the tributary territory or for any other reason.

The Committee of the American Society of Civil Engineers in its "Report to Formulate Principles and Methods for the Valuation of Railroad Property and other Public Utilities," (1917), defines cost of reproduction as follows: "The estimated cost of reproducing the property without deduction for loss of value due to age or other causes."

This method involves the conception of the reproduction of the property as at the date of the valuation. Practice, however, has not been uniform; some valuators have considered all physical conditions as of the date of valuation; others considered historic physical conditions as far as the units of property embraced in the utility are concerned, but all other conditions as of date of valuation; others have considered original conditions throughout; others have considered substitute units in conformity with present day practice, the idea being to ascertain the cost of constructing a utility to perform the same service as the one under consideration.

Some questions arising in connection with the reproduction theory, which are more or less perplexing, might be mentioned. The property of a water company in a city is being appraised for the purpose of establishing a fair rate to be charged the public for water. The water mains were all laid by the company before any paving of the streets was done. At date of valuation, streets have all been paved at public expense. In order to reproduce the water system, it would be necessary to remove and replace the paving. The question to be decided is, should the cost of removing and replacing the paving be considered as an element of cost of reproduction, when the purpose of the valuation is to establish a fair rate to be paid by the public for the water service?

The Grand Central or Pennsylvania Terminals in New York are to be appraised on the reproduction theory. Should this be done on the assumption that the sites of these terminals were covered with buildings which had to be wrecked, as was actually the case, or on the assumption that no buildings existed on the sites at all?

A certain railway is to be appraised by a public service commission for the purpose of arriving at a fair value for rate making. No records of cost are available, but it is known that the company received, from the public paying the rate, a grant of what is now very valuable property. The question arises as to how this is to be treated in a reproduction estimate of cost when the purpose is a fair value for rate making purposes. Is the value upon which the rate is to be based to include the cost of acquisition of the granted land at date of valuation?

A railway was originally constructed through a thickly wooded country and of necessity the clearing and grubbing of the right-of-way was an item of considerable expense, although the actual cost of the land was only ten dollars an acre. Fifty years later the adjacent country has been entirely cleared, is under cultivation and ranges in value from one hundred to two hundred dollars per acre. This property is to be appraised

on the reproduction basis. Is it to be assumed that the cost of the land is from one hundred to two hundred dollars per acre and also that clearing and grubbing has to be done?

Special Considerations in Reproduction Cost

The following extracts from the report of the Special Committee of the American Society of Civil Engineers may be of interest:

"*Wachusett reservoir.* — This reservoir was built to supply water to the Metropolitan District of Massachusetts. To construct it, it was necessary to acquire land on which there were many buildings, and mills with their water powers. Included in the reservoir site there were also many highways and two railroads. As a substitute for the highways obliterated, others had to be built around the margin of the reservoir, and some were raised above the water level. One of the railroads was relocated for many miles at one side of the reservoir, and another was raised. To make the reservoir a better receptacle for water, the surface soil was stripped from its whole area. One main dam and two subsidiary dams were necessary for holding the water. Incidentally, under special laws, damages had to be paid for real estate which was not acquired, but which was said to be damaged indirectly by the construction of the reservoir."

"*Kensico dam.* — This dam, of the New York waterworks, was necessarily located within the limits of an existing reservoir, the water of which could not be drawn down until two new temporary reservoirs had been created farther up stream to maintain the water supply. After these had been completed, the old Kensico reservoir was drained and the old dam removed. After the completion of the new Kensico reservoir, the two temporary dams and reservoirs will be useless.

"*The AuSable dams.* — By building three dams on the AuSable river in Michigan, the Commonwealth Power Company flooded hundreds of acres to a depth of forty feet. There was not a house, not a mile of road, no railroads, no damage to property of any kind such as was encountered in the other reservoirs. It was only necessary to acquire the needed lands and flowage and build the dams, without property damages in any appreciable amount.

There are now no buildings, roads, or railroads in the basins of any of these reservoirs, nor does the connection of the Kensico auxiliary reservoirs with the construction of the main dam appear. Therefore, in these three cases, presently existing conditions are not indicative of work done or difficulties encountered in actual construction in the past, nor of what it is fair to assume would be the conditions to be found had the reservoirs not been built. Conditions may be now essentially similar, immediately about these reservoir sites, but it would seem to be unfair for this reason to assume like conditions to govern the estimate of reproduction cost to be used as a basis of "fair value".

"(1) *Shall present or original physical conditions govern?* — The conclusion of the committee is that, while apparent present day conditions that would affect the cost of reproducing the property must be considered in any logical estimate, yet history must also be considered to determine what is to be reproduced, the conditions under which it is to be reproduced, and how the estimates must be made; that for all those items, concerning which there can be no doubt, the engineer should use the basis plainly applying, and that for those that are doubtful, or have been questioned, he should present the effect of the use of the different bases clearly, that the determining body may have the data for a wise decision.

"(2) *Shall original or present prices govern?* — For reproduction cost the committee recommends that, in estimating, the prices prevailing at the assumed time of reproduction shall be used, meaning the normal price obtained by averaging prices for a proper period, as is discussed subsequently in this chapter under the caption, 'Unit Price's.

"(3) *Shall identical or substitute plant be considered?*— In line with the foregoing discussion, the committee recommends that reproduction estimates be based on the assumption that the identical property is to be reproduced rather than a substitute property; that while apparent present day conditions that would affect the cost of reproducing the property, must be considered in any logical estimate, yet history must also be considered, to determine what is to be reproduced, the conditions under which it is to be reproduced, and how the estimates must be made; that for all those items concerning which there is no doubt, the engineer should use the basis plainly applying, and that for those that are doubtful or have been questioned he should present the effect of the use of different bases clearly, that the determining body may have data for a wise decision; and that normal present conditions shall determine the prices and methods for doing the work."

Hypothetical Development Stages to be Considered

The reproduction idea involves the laying out of a hypothetical development programme taking into consideration, the promotion, organization and financing stage; the construction stage; and the development stage. To the several elements entering into each of the above stages must be assigned an estimated cost.

Promotion Organization and Financing stage.— The promotion of a utility corporation requires initiative, some preliminary investigation, and steps necessary to interest financiers and others in the project. The cost is usually estimated as a percentage of the cost of the whole project. The next step after the promotion is the incorporation and organization of a company, the obtaining of charter and franchise and other features of like nature. The cost of this is usually estimated as a percentage of the whole cost. The next step is to arrange for financing the project, usually by the issuance of securities to be paid to a trustee and advanced by the trustee to the company as the construction of the utility progresses. These securities are usually underwritten by bond houses at a discount, in addition to which commissions must be paid and other incidental expenses incurred. Commissions and incidental expenses in connection with financing are considered as proper costs and are usually estimated as a percentage of the amount of the securities issued. Discount, however, is not usually considered as a proper element of cost in a reproduction estimate, as

it is actually an adjustment of the interest rate and should be amortized over the life of the securities.

Construction stage.— (a) Period of construction:— A reproduction estimate would not be consistent if it assumed the creation of a public utility by a single impulse. A reasonable construction period must be assumed, the duration of which depends to a large extent upon the nature of the property to be reproduced; this might vary from a few months to two or three years.

(b) Inventory:— It is usually necessary to make an inventory of all the items of property involved in a utility and to classify them properly according to a recognized classification. Such inventory should also include a description of each item with remarks as to any special feature which would affect an estimate as to cost of reproduction.

(c) Unit costs of construction:— When the units of property are all inventoried and classified, the next step is to apply unit costs to the various items. These unit costs may be based upon the average for a period just prior to the date of valuation, or, for some representative period prescribed by agreement between the parties interested.

(d) Cost of acquisition of land:— Some of the most difficult questions in connection with valuation on the basis of reproduction arise in connection with land. After an inventory has been made showing the areas of land belonging to the public utility, properly classified in accordance with the locality and nature of the development in the adjacent territory, the question arises as to how the cost of acquisition of the land under the conditions obtaining at the date of the reproduction estimate is to be estimated. Usually a canvas is made to ascertain from actual records of sales and other general local conditions the value of adjacent property at the time of the valuation, or, for a period prior thereto, and the value of adjacent property ascertained in this manner is used as a basic cost in the reproduction estimate. To this basic cost is usually applied a certain factor varying according to circumstances, sometimes called a multiple. By this means effect is given to the fact that a railway or other public utility has to pay for property in excess of the value of adjacent property, because certain strips or areas are required in particular locations and of probably irregular shapes which results in the utility corporation usually having to pay higher rates than would be paid for the adjacent land for ordinary purposes and, in addition, the taking of land usually involves claims for severance or damages. These factors or multiples are usually estimated by reviewing the experience of some other utility for which records of cost are available and applying the multiples or factors so ascertained to the particular case under review. The excess cost may vary from 25 per cent or 50 per cent of the cost of the adjacent land to double the cost.

(e) Engineering and supervision: — During the construction stage it is necessary to carry on preliminary engineering investigations, draw up plans and specifications and to generally supervise the work. The cost of this work is usually estimated at a percentage of the cost of the items involved.

(f) Legal expenses:— This includes any legal expenses which may be necessary, including the costs of litigation, and is usually estimated on a percentage basis, consideration being given to any conditions which may be peculiar to the particular utility under review.

(g) Taxes and insurance during construction:— It is quite possible that arrangements would have to be made for the payment of taxes and for certain insurance during the construction period. This would depend to a large extent upon circumstances and is usually provided for by adding a percentage to the other costs.

(h) Interest during construction:— As it is necessary to provide money during the period of construction for which interest has to be paid in one form or another, and as there is no source of revenue out of which such interest can be paid until the utility has been completed and in operation, it is considered proper to include in the cost an allowance for a reasonable amount of interest during construction, such interest being computed upon the basis of the amounts assumed to be expended from time to time during the construction period.

(i) Contingencies:— In an estimate made as to the cost of any work, it is customary to add thereto an allowance to cover all uncertainties in the quantities and prices or for unforeseen conditions, as in actual practice it has been found that even under the most careful investigation as to quantities and prices, conditions which could not have been foreseen develop and add to the cost This item of contingencies is usually estimated on a percentage basis.

(j) General administration:— In addition to the foregoing, there are usually certain general administration expenses which have to be provided for during the construction period and which may be estimated as a percentage of the other costs.

The development stage.—At the date of the completion of the public utility there exists a plant ready to do business in what might be called a "bare bones", inert condition, ready to function but not actually functioning. It requires to be built up and developed. This can only be done by the energy, perseverance and solicitation of the officers in charge and usually takes some considerable time and involves some considerable expense. It might be designated as the expense necessary to bring the plant from an inert state to a 'going concern' state.

It is considered by some writers that the amount which should be added to cover development cost should represent the deficiency between the actual return and the fair return on the investment in the first few years of operation. In fact, it is considered that this development cost is substantially the same as interest during construction and consequently chargeable to capital.

Cost of Reproduction Less Depreciation

The only consideration necessary with respect to this phase of valuation is in connection with the term "depreciation", and no discussion on the subject of practices of valuation would be complete without a reference to it.

Depreciation is essentially an expedient adopted to anticipate and provide for a condition which it is expected may have to be met at some future time. It is, however,

a subject which has been very much discussed. It is defined in the dictionary as, "a belittling or running down of value or merit; a fall in value; reduction in worth; the act of lessening or bringing down price or value."

The committee of the American Society of Civil Engineers in its report says, — "Perhaps there is no single subject in connection with valuation that has caused more trouble than depreciation. This has been due to various causes, perhaps not the least of which has been confusion in the use of the term. Depreciation is sometimes used to mean decretion, which is loss of service life, sometimes to mean the money allowance made in bookkeeping to offset accruing loss of service life, and sometimes the loss of value existing at any time due to loss of service life or any other cause. The committee will use it only as meaning the loss of value or worth of property units which are parts of 'going concerns'."

A writer says that the engineer's conception of depreciation is an amount to be determined and deducted from original cost, or cost of reproduction, in valuation practice in order to reach present physical value. It has been defined as the loss of value due to age and use, including the loss from deterioration, wear and tear, inadequacy, obsolescence, depletion and other similar causes. It has also been defined as the lessening in worth of physical property due to use, approaching end of useful life, or other causes. It cannot be made good by repairs, but only by replacements. It must be clearly distinguished from loss of efficiency which does not begin until depreciation is almost complete. Some writers prefer to use the term "decretion" when referring to loss of service life or lowering of physical condition or the gradual approach of the time when the physical unit can no longer function because of age, decay, accident, inadequacy, obsolescence or other causes. The committee of the American Society of Civil Engineers in its report uses the expression "decretion" in the sense just mentioned. This committee, as well as some writers, refers to depreciation only in the sense of the loss of value or worth. Decretion in this sense is that loss of service life which cannot be made good by repairs. Depreciation in this sense would include the loss of value due to decretion as well as that due to of lack of repairs. It is a stern cold fact, however, that in the case of every public utility at some time in the future, certain or all of its units will from one cause or another, cease to function. Call this feature what you may, failure to appreciate it and provide for the same is often very disastrous.

There is a considerable difference of opinion amongst engineers and others as to whether or not, in a reproduction estimate, anything should be deducted for depreciation. The argument advanced by the exponents of the theory that no depreciation should be deducted, point out that if a utility is properly maintained and in such a condition that it requires no expenditure of money to improve its physical condition, no depreciation ought to be deducted, because the machine is functioning just as well as if it were new and, insofar as the rendering of service is concerned, it renders that service just as well as if it were new. In case of the purchase of a public utility, it does not seem reasonable that a prospective purchaser in arriving at the value could fail to take account of the fact that although in perfect operating condition, there are physical elements in an old property which are nearer to the date when they will cease to function than they were when new and to make corresponding deductions from any estimate of reproduction new.

In case of the ascertainment of value for rate making, let it be assumed that a reproduction estimate has been made and the amount by which the existing elements fall below their condition new ascertained. Should a deduction be made from the estimate of reproduction for rate making? Essentially the object in view in the establishment of a rate to be charged by a public utility for service to be rendered is, that the rate shall be fair and reasonable to all concerned, that is to say, it shall be such that all operating expenses are met and a reasonable return made upon the reasonable value of the property used in the service. If in the course of time, the physical property of the utility has reached a condition somewhat below its condition when new, but which might be called normal operating condition, and will require in the future only normal expenditures to maintain that condition, but during the period taken to reach its present condition from new the owners have received rates sufficient to pay operating expenses, including accruing depreciation, and a fair return on the fair value of their property, and have chosen to take out in dividends the amount representing the accruing depreciation, then obviously something should be deducted from an estimate of reproduction on account of accrued depreciation which, in this case, represents capital actually returned to the owners. If, on the other hand, the rates in the past have been subject to regulation and have not been sufficient to cause this return of capital to the owners, then no depreciation should be deducted.

Going Concern Value

'Going concern' value, as distinct from development cost, is a value which is placed upon a utility in addition to its 'bare bones' cost, because of the fact that the plant is functioning, it may be more or less in terms of money than the development cost.

Mr. Leonard Metcalf in a paper read before the American Society of Civil Engineers in 1909 says:

"It may be defined as the cost of establishing, up to the level of the net income of the old plant at the date of taking, the business of a similar new plant, (but not of a more perfect system which the city might build), which is supposed to begin operation upon the date of the taking, the old plant going out of business at the same moment. Or, to put the same thing in another way, it is the measure of the greater value, (at the date of taking), of an old, established plant, over a similar new plant completed and ready for operation upon the date of taking. Or, to put the same thing in still another way, it is the measure of the cost of developing the business of a new plant to a point coincident with the net income, upon the date of taking, of the old plant."

An engineer named Alvord advanced a theory in 1902 for ascertaining 'going concern value', which is described as follows:

"It is assumed that a new plant will be constructed, the inception of which is coincident with the date of arbitration. Such new plant is to be of an equal capacity with the older plant under consideration, and a due allowance of time in which to construct this new plant, and the necessary capital to be invested in it from time to time is estimated. At the completion of this new imaginary plant, it is assumed that it commences to obtain business in that community from those who are not previously accustomed to the free use of public water, except in a general way and that it is to require the business ability and consequent

increase in number of customers which the earlier and older plant went through within the early years of its existence. An assumption of the amount of business thus created for each year for a period of years in advance is carefully computed and estimated by the board of arbitration. The losses of interest upon capital invested are duly fixed, as well as the first absence and later addition or revenue from hydrant rentals, and a table is prepared showing each year, the total business developed and the total losses, if any. After this is completed a forecast is made of the business of the older works for the same period of time in the future that it takes the business of the new works to equal the business of the old works. If the business of the old works is found to be a growing one it will be a longer period that the new works will require to overtake it than will be the case if the business of the older works is stationary or decreasing. In general, the differences which might be called the debits and credits of this new imaginary plant and the debits and credits of the older working plant are reduced to their present worth at the time of appraisement, and an estimate is made which will adequately represent the financial advantage which the old works, (already fully equipped and in running order and having a large number of profitable customers), will have over the new works, where everything must be built and customers secured.

"It is necessary in making this supposititious estimate of the new plant to consider it in no way a competitor of the older works; there is not supposed to be competition between the new and the old, but it is left to the experience of the board of arbitration to consider how long it would take the new company to build new works, and build up business for the new works, until they have overtaken the business of the old company should it continue to occupy the same territory."

Agency and Competitive Theories

A noted authority in the field of valuation, Halbert G. Gillette, states that the differences in opinions held by appraisers with respect to important points arising in connection with the valuation of public utilities for rate making arise from a difference in conception as to the relation of the public utility to the public.

Broadly speaking there are two conceptions or theories which, unconsciously perhaps, influence the minds of appraisers. They are radically different. These theories have been called, the "agency theory," and the "competitive theory."

According to the agency theory the public utility corporation is an agent of the public, authorized and bound to render to the public certain service for which it is entitled to receive from the public a sum sufficient to meet all operating expenses and, in addition, a fair return upon the capital invested. According to the agency theory, therefore, the value for rate making purposes is the reasonable actual investment in the property. According to the competitive theory the public utility corporation is authorized to render the public certain services and is entitled to receive from the public whatever the traffic will bear under competitive conditions. According to this theory the value of the property would be the cost of reproduction less the capitalized difference in annual cost of production of service or operation by the existing plant as compared with the most modern plant.

Recent Valuation Cases

Among the more recent valuation cases are the following: Valuation of the Canadian Northern Railway and Grand Trunk Pacific Railway by the Royal Commission appointed by the Dominion Government; the Winnipeg Electric Railway by the Public Service Commission of Winnipeg; Ottawa Street Railway by the City of Ottawa; the United States Interstate Commerce Commission valuation of railroads; valuation by the State Board of Assessment for Wisconsin of the railroads properties; the valuation of the properties of corporations in Michigan, made by the board of Tax Commission. There have also been a large number of joint facility valuations by railways in Canada for the purpose of arriving at a rental for the use of facilities, notably at Quebec, Montreal, Ottawa, Toronto, the Toronto to Hamilton joint section, the Windsor to Bridgeburg joint section, Winnipeg and at other points.

Some Fuel Problems of the Steel Plant

A review of the Requirements and the Distribution of all Available Fuels.

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Paper read before the Sault Ste Marie Branch, The Engineering Institute of Canada, April 1922.

This paper is intended to show the possibilities which present themselves for a more complete utilization of the coal and by-product fuels in the manufacture of steel products from raw materials. Not so much from the standpoint of efficiency in the furnaces and appliances of various kinds, but in the arrangement of a general programme covering the entire fuel problem from the mine to the last smoke stack. While there is a wide field for increased efficiency in the use of fuels in every branch of the industry it in no way compares to the possibilities which exist in almost every steel plant for the elimination of the loss of fuel on account of the lack of co-ordination of the problems of the various departments under one efficient head. The surplus fuel of one department can often be made available for another department and a large credit obtained where previously none was received.

Frequently peak load demands on fuel and power are produced by several departments at the same interval of time which can be scheduled into a uniform load over the entire period, and thereby eliminate numerous delays, increase production and reduce costs. An example to

illustrate this point occurred at a plant where the writer was employed. The delays were very numerous on account of steam, with a generating capacity of 6,000 boiler horse power while the same plant afterwards was operated to a greater capacity with 3,500 boiler horse power, with no delays for steam and a number of boilers were permanently disconnected from the steam mains, thereby saving thousands of dollars per month.

In the various departments where coke oven gas is available it is necessary to determine at which plant the gas can be used to the greatest advantage and at which plants it will be necessary to use producers or other fuel, as almost every department head will insist that it will be utterly impossible to operate his plant with any other fuel but coke oven gas owing to numerous reasons. Also there are various uses where efficiency of one fuel over that of another are at wide variance and a proper selection means large financial gains. There is also a great difference in the value of coals for all metallurgical purposes dependent upon the uses for which they are employed, and the selection of the coals should have the greatest inspection possible both at the mines and at the receiving station. It is worthy of notice that all finished products of the steel company are scrutinized with almost microscopic closeness and both physical and chemical tests are made of every heat, yet it is a rare occasion when the most important material that goes into the production of steel receives more than the superficial inspection of more or less incompetent help.

The coal used by the Algoma Steel Corporation is produced at the mines owned and operated by the parent company. They are the Algoma mine in McDowell county, West Virginia, from which is produced a semi-bituminous coal known by the trade name of Pocohontas coal, and the Cannelton mine, which is also in West Virginia, and from which a bituminous high volatile coal is produced. The proportions in which the two coals are received depends largely on their market value and has been, at the coke plant, in proportions varying from 20 per cent of the former to 80 per cent of the latter, to a 50-50 mix.

Owing to the necessity of accumulating the entire year's supply of coal during the time the lakes are open for navigation, the company is confronted with the problem of properly storing the coal to secure the least heating and weathering effects. As it is frequently necessary to store over 500,000 tons of coal, the piles are deeper than desirable with the consequential over-heating and spontaneous combustion. Cross cutting and rehandling of the parts effected must be resorted to and large quantities of the fuel thus effected are rendered useless for coking and gas-making purposes. The coal thus transferred is therefore utilized for some other purpose at a considerable loss to the company.

The weathering of the coal in the pile is very noticeable as the winter progresses, as it produces less gas, and gas of a lower value than does the new coal. This result is immediately reflected in the practice of the furnaces showing a considerable loss as compared with the results when new coal is used. The fine or slack coal when received directly from the mines can be used in the producers with little complaint from the gas makers, but after weathering for a few months it is impossible to maintain either the quantity or quality of the gas sufficiently for open hearth requirements, which necessitates securing a large percentage of lump coal by means of screening the pile. The slack screened out is sent to the coke plant where it is also objectionable, as a poor grade of coke is produced and the by-products are also detrimentally effected thus reducing plant income to a considerable extent. The lump coal is weathered an appreciable amount, but not as badly as is the slack. This is due to the fact that only the surface of the lump comes in contact with the air. Weathering is a common term used to indicate that the coal has absorbed a quantity of oxygen and consequently the ratio between the oxygen and hydrogen has been reduced. If the oxidation proceeds faster than the heat is dissipated the temperature of the pile rises until ignition is the result. C. H. Porter of the Bureau of Mines gives a number of rules which, if followed, will prevent spontaneous combustion in the pile. Among them are the following:

1. Store only screened coal larger than one inch.
2. Avoid accumulation of old coal underneath new lots.
3. Store in piles having no interior point more than eight feet from an air cooled surface.
4. Rehandle coal reaching a temperature of 120 degrees F.

The coal for use in gas producers should have special selection and be properly sized. The fines, under an inch in size, should be screened out, together with all the lumps that will not pass over a two-inch screen. Special care should be taken to secure a gas coal with a low sulphur content and also a high fusion ash. The Cannelton coal answers to these requirements, except as to size and this feature is now a problem of live interest.

In order to get the values of the various fuels in such a form that one kind can be compared with the other, it has been the custom of engineers and chemists to compare them on the calorific basis. As the calory is a quantity seldom used in every day life and consequently hard to visualize, the unit of measure adopted herein is a pound of coal. The pound of coal is assumed to have the calorific value of 13,200 B.t.u., which was the average heating value of the coal received last season. In referring to a gas with an equivalent value of a pound of coal, it is meant that the amount of gas will have the same heating value as one pound of 13,200 B.t.u. All of the fuels in use are calculated on a coal equivalent basis. In some cases it would be impossible to substitute coal for the gas used and secure the same quantity of coal per ton of product, as a higher efficiency is obtained with the use of one fuel than with the other. However, as all the practices are commonly calculated on the pounds of coal required per ton of product, it will be far easier to compare than if the calorific value is used.

As was just stated, it is often possible to secure a higher efficiency in the use of one fuel than with another. This is particularly true in the case of using coke oven gas and tar. The coke plant might, therefore, be considered a plant for the transformation of coal into more desirable forms of fuel. The main object of course is to produce blast furnace coke, and all other products derived are incidental to the operation, but none the less important. For the purpose of this paper we are interested only in the by-products which are considered metallurgical fuels,

consisting of coke, gas and tar, but ammonium sulphate, which amounts to about twenty pounds per ton of coal, coked, is an item of importance. One hundred pounds of dry coal charged in the ovens will produce: 66.8 pounds of blast furnace coke, 5.25 pounds of breeze, 4.75 pounds of domestic coke, 3.45 pounds of tar, and 19.75 pounds of volatile matter of which 0.22 pounds will combine with sulphuric acid to form ammonium sulphate. The remainder represents 510 cubic feet of gas, or a ton of coal will produce 10,200 cubic feet. Of this amount 45 per cent is used by the ovens to maintain coking temperatures and the balance is available for other uses. Owing to the value of this gas for other purposes, a cheaper fuel may be used for heating the ovens at a distinct advantage, under some circumstances.

The coal equivalent values of the by-products from the coke ovens, per ton of coal are: 6.3 Imperial gallons of tar, 86 pounds; 200 pounds of breeze and domestic coke, 176 pounds; 5,610 cubic feet of gas, 212 pounds, or a total of 474 pounds of equivalent coal, and gas used to heat ovens, 173 pounds of equivalent coal.

The blast furnace must also be considered a source of fuel as it is a producer of a valuable fuel gas, depending in quantity and quality on numerous variables beyond the scope of this paper to analyze, but subject mainly to the character of the charge and specifications of the product.

Where iron ores are obtained from the Lake Superior mines and basic iron is being produced, the practice will average about 2,000 pounds of coke per ton of iron. From Brasserts formula, there will be 142,800 cubic feet of gas per ton of pig iron with a heating value of 94.5 B.t.u., per cubic foot. This gas has a coal equivalent of 1,022 pounds of coal. Of this amount, 40 per cent will be used for the hot blast stoves, and 15 per cent for the gas blowing engines, leaving a surplus of 460 pounds in equivalent coal. As only two-thirds of a ton of coke is produced by a ton of coal, the surplus of gas on this basis will be only 307 pounds. With the surplus fuel from the coke plant, we now have available 781 pounds of coal for other purposes, from every ton of coal charged at the ovens, and the coke produced used in the blast furnaces.

The requirements to produce a ton of finished rails, are as follows: Assuming the practice from ingot to car to be 80 per cent, ingot to blooms 86 per cent and open hearth practice 93 per cent, we will require to produce one ton of finished rails, 1.16 ton of blooms, 1.25 ton of ingots and 1.34 ton of steel from the open hearth. Coal required to heat 1.16 tons of blooms at 90 pounds per ton, 104.5 pounds; 1.25 tons of ingots at 130 pounds per ton, 162.5 pounds; 1.25 tons of ingots at 500 pounds per ton 625.0 pounds; or a total of 892 pounds of coal is required to produce a ton of rails from the open hearth.

The charge in the open hearth contains normally 50 per cent hot metal from the blast furnace. To maintain this ratio the amount of pig iron required to produce a ton of rails will be 50 per cent of 1.34 ton, or 0.67 ton. To produce 0.67 ton of iron requires 0.67 times 2,000 pounds of coke, or 1,340 pounds. The coal required to produce 1,340 pounds of blast furnace coke is 2,000 pounds.

Coal Required	Pounds of Coal per ton of rails
To produce blast furnace coke	2000
As shown previously was	892
Steam power, 59 h.p. at 4 lbs., per h.p.	200
Electric power and lighting 109 k.w. hr at 5.4 lbs.	540
Steam for heating, 20 h.p. at 4 lbs., per h.p.	80
Transportation and steam cranes	70
	Pounds of Coal
Total coal required per ton of rails	3782
Surplus fuel available from by-products	781
Net amount of fuel required to produce a ton	3001
If 100 k.w. hrs., electric power purchased	540
The fuel requirement will be	2461
40 boilers h.p., will be available per ton of rails if waste heat boilers are installed in the open hearth, giving credit to fuel account of	160
	2301

The problem of using the by-products from the coke plant and the blast furnaces in order to secure the efficiency which is now being obtained with the use of other fuels must be solved in order to operate at maxinum efficiency. The character of these fuels themselves adapt them naturally to different uses. The coke oven gas and tar which are of high calorific value and produce high flame temperatures of combustion can be used for open hearth fuels, and the blast furnace gas for soaking pits and reheating furnaces, or a mixture of both gases may be used for either purpose.

The open hearth furnace has adapted to the use of so many different kinds of fuels and fuel combinations that little need be said regarding the use of tar and coke oven gas, except as to the proportions in which they are derived from the coke plant. This proportion is 6.3 Imperial gallons of tar to 10,200 cubic feet of gas, when the assumption is made that all of the gas produced by the coke plant is available for use. This gives a total heating coal equivalent of 474 pounds of coal. As this is lower than the average open hearth fuel requirements, it will be necessary to redesign many of the furnaces, but as this practice has frequently been bettered in many plants it is no mere speculation. In fact one plant claims to have a fuel practice on the use of coke oven gas alone, of 360 pounds of equivalent coal. The practice in one of the large steel plants using combined tar and gas varied from 16 to 20 gallons of tar, and from 5,000 to 8,000 cubic feet of gas, with fuel practices of about 560 pounds of coal. In the plant of the Algoma Steel Corporation a number of heats were made on coke gas alone, with a fuel practice of about 500 pounds of coal. It can, therefore be concluded that the open hearth fuel problem can be solved in a very satisfactory manner, with an ample supply of excess coke gas and tar to allow for slowing down of the furnaces and other emergencies. Also 400 cubic feet of gas can be used per ton of steel for ladle, mold, drying and hot metal mixer.

This use of fuel in the open hearth plant will discontinue the use of producers, which at the present time are more or less unsatisfactory in the production of gas, as the quality and quantity varies over 100 per cent dependent on numerous variables, of which the human element is the greatest.

The proper use of blast furnace gas is not for steam making, although this has been the aim in the past to make such use of it. Should the proposition be advanced to employ producer gas for steam making the question would be dismissed without discussion, as it is well known that no fuel efficiency could be obtained due to the combined losses in efficiency of the producers and the boilers. The use of the coal directly in the boiler would produce more steam than if fired into the producer; why then bother with producer gas? That is the point to be made clear; why bother with blast furnace gas to make steam? It is more valuable for other purposes. Use breeze and waste heat boilers for that purpose. In the above calculations it was shown that 176 pounds in equivalent coal in nut coke and breeze was available from a ton of coke, or for a ton of rails at the rate of 4 pounds of coal per boiler horse power and this will produce 44 boiler horse power. Also it is possible to secure 40 boiler horse power from the use of waste heat boilers. This will be ample for, all purposes where steam is required. The other necessary power may be derived from electricity generated by other means. The blast furnace is the only gas producer which should be tolerated in a steel plant, as the gas produced is of fairly uniform quality and the quality is satisfactory for all the purposes in reheating furnaces, soaking pits and other places where producers have long been used. It will be necessary to clean the gas and distribute it under a relatively high pressure with sufficient holder capacity, but these problems have all been solved in many plants. Also the use of blast furnace gas has been adopted for reheating furnace to some extent, and the experimental stage has been passed. It has been shown that 307 pounds of coal equivalent value is produced by surplus blast furnace gas, and that only 267 pounds were needed in the reheating furnaces. This practically balances the account of blast furnace gas.

In our problem we have not mentioned the fuel required for heating purposes, as this varies throughout the year, but for the six months of winter it will average 20 b.h.p., hours, with a fuel requirement at the boilers of 80 pounds of equivalent coal. It also requires 70 pounds of coal for the transportation of products needed in the production of a ton of rails. This fuel will of necessity be a good grade of coal.

It has been shown that the by-product fuels produced in the manufacture of a ton of rails will not be sufficient to supply all of the heating and power requirements that enter into the production of the rail from the raw products, 336 pounds of additional fuel will be required in the open hearth furnaces per ton of rails, or if all of the coke oven gas is utilized and the fuel practice improved thereby; 173 pounds of coal equivalent will be needed to heat the coke oven batteries. This fuel can best be supplied by blast furnace gas. The necessary additional amount of which could be obtained by the production of 15 per cent more iron than is used in a ton of rails.

By adding 15 per cent extra iron from the blast furnaces to that required for a ton of rails we will have the following fuel balance.

Coal required in pounds		Surplus or by-products obtained. Coal equivalent in pounds.
Coal at coke plant	2,300	
Blast furnace coke		1,536 coke plant.
Breeze		199 coke plant
By-product gas		542 coke plant
Surplus blast furnace gas		529 blast furnace
Steam — open hearth		160 waste heat
Coal for transportation	70	
Total fuel	2,370	2,966

Fuel requirements for	Coal equivalent in pounds
Heating coke ovens	200 blast furnace gas
Reheating furnaces	267 blast furnace gas
Open hearth furnaces	542 coke gas and tar
Blast furnace	1,536 coke from coke ovens
Steam power and heating	160 waste heat, boilers
Steam power and heating	202 breeze
Total fuel requirements	2,907
Excess fuel for other purposes	59

Accident Prevention in Industrial Plants

The importance of Accident Prevention as Demonstrated by Results of Campaigns in the Cement Industry.

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Paper read before the Montreal Branch, The Engineering Institute of Canada, February 21st, 1922.

Among world movements which have changed the meaning of life in a revolutionary manner, few can compare with modern industry. Before the industrial era was the period of craftsmanship, when each worker exercised his handicraft in his home and the excellence of the product was a matter for family pride. People that had a trade, lived, worked and died under the same roof where they were born and very likely their parents and grandparents too. This was the good old order of things, respect for which led the Lancashire cotton spinner to wreck the first power-looms, and craftsmanship has been fighting a losing battle with the factory idea ever since, till now it is almost annihilated.

The advantages at which modern industry aimed have been attained. Uniformity of product, cheapness of product, world-wide distribution and interchange of commodities, a higher standard of comfort made available to more people, all these material advantages have been obtained, and permit one to regard industry, ideally speaking, as synonymous with social service. But while the eyes of the masters of industry were fixed on the guiding star, "production", other things happened, which were bound to happen, but had not been taken into account. The factory, aiming at low cost of manufacture, located near the city, which offered easy transportation, cheap labour, and a local market. The workman, for convenience sake, elected to find living quarters as near the factory as possible.

The sequence of events, fluctuation of labour demand, rapacity of landlords, influx of lower-grade workingmen, and degrading domestic circumstances, produced the slum areas in our great cities. Children reared in necessarily unhealthy surroundings, underfed, half-educated and diseased, grew up to propagate their species. The discards of industry, the maimed and over-age were thrown on the community, which in a bewildered and disorganized way gave them occasional support by way of charity. For many years factory management ignored these things which were the by-product of modern industry, and continued to treat their workers as manpower to be purchased as required in the interests of economy of production, like any of the raw materials of manufacture. This was the state of affairs which produced the hard hearted and inhuman factory superintendent, and bred mistrust, suspicion and defiance in the worker. This gave rise to the mistaken theory that in industry, capital and labour are enemies, a theory which has been used extensively by labour agitators and trade unions.

Present day factory management however takes a broader view of its problems, and the community is now awake to the social evil that has accompanied the progress of industry. Labour is no longer amenable, as it used to be. The fathers have eaten sour grapes and the children's teeth are set on edge. Management is now fully aware that the best economy in industry is obtained by treating the workman as a potential partner in the business, by removing as far as possible the fear of unemployment and of the destitution it entails, by providing him a house to live in, educational facilities for his children and himself; by protecting him and teaching him to protect himself from the hazards of his employment, and providing for his maintenance in old age. This is the way in which modern management is bidding for the employee's confidence, but in the light of the past history of industry it can hardly be wondered that the workman is slow to respond; suspicious of labour saving machinery, mistrustful of welfare work, and profit-sharing or bonus schemes. However there is a response, and in no way has it been more evident than in the success of properly organized accident prevention work.

Accident Frequency in the United States

During the week of August 22nd to 28th, 1921, there were 1,208 persons killed by accidents in the United States. It is a notable fact that automobile accidents form 26 per cent of this total, railway accidents 21 per cent and drownings 12 per cent. Industries contributed only 29.7 per cent of these fatalities, but it is industrial plants that offer the most favourable field for the work of accident prevention. Industries, then, killed 359 people in the United States in one summer week.

Turn your thoughts for a moment to consider how the untimely death of one man may involve the distress and misery of numbers of innocent sufferers, and you will quickly realize what a volume of domestic tragedy may underlie the cold statement of fact which statistics here afford us.

The elimination of this industrial death roll is a cause which must appeal to every man who values his own life — and most of us do — furthermore it is an ideal towards the attainment of which every man of us, engineers or employers of labour, can contribute his efforts.

Principles of Accident Prevention

In the prevention of accidents in industrial plants there are two lines of attack each of which at one time or another in the history of accident prevention has been hailed as a cure-all to the exclusion of the other. The two slogans are, "Make your plant safe," and, "Make your men safe."

Experience shows that the extremists on both sides are wrong. There is no such thing as a safe plant, and, more obviously, there is no such animal as a safe man. One can design a plant to make it as safe as possible,

and one can train a man to be as careful as possible and the way of safety is to attack the problem from both sides at once.

Statistics in the Cement Industry

In the cement industry, with which the writer is most familiar, we have analyzed causes of accidents for a number of years and the writer proposes to present certain facts which have been ascertained and draw the appropriate conclusions regarding the part which the engineer and the operating foremen respectively may assume in the common cause of accident prevention.

In tabulating accident reports, account is taken only of such accidents as cause a loss of time to the worker, and accidents are weighted according to the time loss which each involves. Fatalities are separated out and analyzed apart from the general list. The following is a typical report by the Portland Cement Association on causes of accidents covering one year:—

Analysis of Accidents Covered One Year

Average number of men employed 18,400

Causes of Accidents	Number of Accidents	Number of Days Lost	Average Days Lost	Permanent Disabilities
Ailments in course of work......	15	195	13.0	
Animals, injured by............	13	191	14.7	
Articles in hands of injured.....	79	805	10.2	2
Articles in hands of other person	46	548	11.9	
Caught between objects or parts	150	1871	12.5	7
Clothing caught in machinery..	6	392	65.3	1
Contact with hot material......	99	1670	16.8	
Electrical equipment...........	40	630	15.7	
Explosions.....................	56	1866	33.3	2
Falls due to defective platforms	49	1350	27.5	
Falls from machines, etc........	33	755	22.8	
Falls through unguarded openings....................	21	305	14.5	
Falls due to tripping and slipping.......................	159	3459	21.7	2
Falling or sliding objects.......	515	7757	15.1	6
Flying material................	330	2607	7.9	6
Machinery......................	137	3506	25.5	21
Machine or appliance part broken........................	189	2928	15.6	2
Belts..........................	59	1777	30.1	1
Gears..........................	30	1239	41.3	13
Pulleys and sheaves............	13	392	30.1	1
Shafts and couplings...........	10	268	26.8	
Sprockets and chains...........	14	193	13.7	2
Rolling stock..................	248	5923	23.8	16
Sharp edges or points..........	98	849	8.6	
Striking self against parts......	46	796	17.3	
Strains from lifting...........	133	1545	11.6	
Suffocation....................	5	24	4.8	
Horseplay......................	4	96	24.0	
Miscellaneous..................	71	813	11.4	
....	2668	44750		

Among causes of accidents in this tabulation, "falling or sliding objects" heads the list. Out of 18,400 men employed continuously during the year, 515, or one in thirty-six, suffered injury from falling or sliding objects. This is a cause of injury which can be eliminated by training the men in carefulness and by insisting on cleanliness in the plant. The engineer has very little scope here and the remedy is in the hands of the superintendent, foremen and sub-foremen and the individual worker.

The cause that comes second in frequency is "flying material" with 330 accidents, mostly light, for the average number of days lost is only 7.9. These will be principally eye accidents, indicating the importance of wearing goggles or masks when exposed to hot clinker dust or cement dust, steel chips in the machine shop, splashes of molten metal and similar flying material. This again is a matter to be tackled by discipline and training. Goggles are provided and the men must be persuaded that it is desirable to wear them, or, if necessary, penalized for not doing so.

Rolling stock is responsible for 248 accidents with an average loss of over three weeks time. Here it is the business of the engineer to see that maintenance of rolling stock and tracks is not allowed to slide, and that necessary warning signs and proper lighting at switches and cross-overs is provided. The plant organization is responsible for stopping dangerous practices such as stealing rides, and for educating the men not to take risks in coupling cars, and in dumping. Careless coupling caused five permanent disabilities in the list, mostly lost fingers.

Accidents with gears are usually serious. Among thirty accidents recorded, thirteen caused some permanent disability, the loss ranging from "end of one finger" to "the whole arm", Gears should be guarded: this is not proof against gear accidents, but it helps.

Passing to the record of fatal accidents, causes are stated as follows:—

Belts:—Belt broke, striking man and fracturing skull, one; stepped on or fell on belt, one; found dead near belt, one; cleaning clay off conveyor belt and shovel broke, one; dressing belt, can caught in wheel, one; struck by belt and skull fractured, one.

Coal Dust:—Exploded, causing death, three.

Clothing Caught:—Collar on shaft, one; line shaft, one.

Electrical:—Contact with trolley rail, one; contact with live wire one; exact cause unknown, one; found lying on feed wires, one.

Explosives:—Springing hole using very short fuse, one; tamping powder and it exploded, seven.

Falls:—Slipped and fell on flywheel, one; fell off dam and drowned, one; fell into clay bin, suffocated, one; fell backward and struck head on concrete floor, one; fell through opening in roof, one; lost balance, fell backward eight feet, one.

Gases: Asphyxiated by gases in kiln hopper, one.

Machinery:—Stepped into screw conveyor, four; sitting on crane, when cab swung around, one; repairing inside of the tube mill, and mill was started, one; killed by belt conveyor, one; caught on driving sprocket, one; pinion bumped out of mesh, causing elevator to run backwards, one; chain broke, pulling man around shaft, one.

Rolling Stock:—Car on incline ran over man, one; caught between cars, two; falling under wheels, one; stepped in path of cars, two; fell from handcar, one; fell off car, one.

Slides of Material:—Stone storage bin, one; cement storage bin, one.

Stones Falling:—Rock fell from face of quarry, one.

Miscellaneous:—Found dead, causes not known, two.

Total, fifty-three.

Analyzing these fatal accidents, we have been able to assert with a reasonable degree of certainty that 15.5 per cent only were unavoidable, 14.1 per cent were due to lack of proper supervision, 19.7 per cent due to lack of proper safeguards, and more than 50 per cent were to be blamed to the workmen themselves.

It must be borne in mind that these statistics refer to only one industry, and are compiled from one year's reports of only seventy-two Canadian and American companies in that particular industry. It is safe to say that in the matter of accident occurrence the general conclusion regarding responsibility will be found more or less the same in any industry, and the methods of attacking the problem of accident prevention are of universal application.

What the Engineer can Accomplish

An engineer's object, as a rule, is primarily to lay out an economical plant, to arrange his machinery con-

veniently but compactly, to cut down expense, and to design the mill in such a way that the flow of raw material entering and finished goods issuing may be continuous and regular. The human labour that has to enter into the process of manufacture, is one of the engineer's troubles and, while reminding him of the limitations of his science of mechanics, is constantly tripping him up in his design, and introducing requirements which have no direct relation to the economical lay-out of his plant from the standpoint of mechanical efficiency. Hence the engineer is led to study his design also from the angle of human efficiency.

Human efficiency in industry depends on a number of things but among the bad influences, fear of one kind or another is the worst. This may be fear of bodily injury, fear of injustice or violence, fear of unemployment, fear of ill-health or fear of old age. It is the engineer's business to eliminate from these fears, the fear of bodily injury and the fear of ill-health. He should lay out his machinery with all hazards, mechanical, electrical or chemical, properly guarded. He should provide ample and clearly defined alleys, and walk-ways guarded with rails and toe-boards. His alley-ways and walk-ways should be free from slipping and tripping hazards, his stairways convenient and safe, his artificial lighting ample and properly distributed. He should consider the comfort and safety of the oiler and make all bearings accessible. Portable ladders should be classed as emergency apparatus. He should provide lifting beams or travellers for handling repairs of heavy machinery. The engineer should study also to preserve the health of the worker, providing proper ventilation and heating, lavatories and lockers, first aid and hospital accommodation, drinking water, lunch rooms or club house facilities, and other creature comforts. Provision of all these features in a plant lay-out costs money, but it is an investment which earns dividends. As an example of the effect of eliminating fear of injury on small piece work, might be cited the experience of the Cutler Hammer Manufacturing Company, who by adding a safety feed to a certain punch press reduced the production cost of the piece from 32 cents to 8 cents per thousand.

In the branch of accident prevention over which the engineer has at any rate partial control must be included occupational hazards. In a pamphlet entitled "Occupational Hazards and Diagnostic Signs", prepared by Dr. Dublin and Mr. Leiboff for the Metropolitan Insurance Company, health hazards are listed under the four principal heads of dust, heat, humidity and poison. After giving a tabulation of the diseases incurred and the industries or occupations giving rise to them, the writers append a list of over 500 industries or occupations involved. This demonstrates the magnitude of the problem before us as engineers when we set out to remove the fear of bodily injury from the worker in industry. The article referred to will be found in the United States Monthly Labour Review, March 1921, page 158, and gives an appalling catalogue of the dangers to which the health of the worker may be subjected in various industrial occupations.

The Safety Engineer

The man who aspires to be safety engineer in any manufacturing organization is choosing a profession of absorbing interest and incalculable service to humanity. The men at the head of the profession are men of high ideals, based on a record of service which has enlarged instead of decreased their faith in those ideals. One of these men, Charles Close, manager of the Bureau of Safety Sanitation and Welfare of the United States Steel Corporation recently said, "I believe the day is coming when we will have no accidents in industry. You and I may live to see that day. But to bring that about we have to develop a new generation of workmen. We must train the child so that he will develop habits of safety. We must do more than show him the safe way of doing things once, twice, or ten times. We must teach him the safe way of doing things *every day*, so that when he comes into the shop as a workman, he will habitually do the safe thing just as his father to-day habitually does the unsafe thing."

One must guard against the impression that safety engineering is a side line. It is no more a side line than surgery is a side line in the doctor's profession. The safety engineer must be a good engineer with a broad general education, but he needs special training and experience in hazards and in the special hazards of the industry to which he is allied. He has to be a good mixer, something of a diplomatist, and a confident speaker on occasion. If to these attributes he can add from his personal character an infectious spirit of enthusiasm, and a profound conviction of the paramount value of human life and health, there is no limit to the value that will be placed on his services, and to this material consideration will be added the satisfaction of a life of tangible service to humanity.

Accident Prevention Campaigns

The motives underlying the initiation of a campaign for accident prevention are various. The earlier attempts of legislation to protect the worker in industry took the form of Employer's Liability Acts, and this class of legislation trained the manufacturer to regard accidents as matters about which secrecy should as far as possible be preserved, and they were afraid to guard or improve the protection on machines after an accident had occurred, lest this action should be used against them as evidence of improper conditions increasing their liability.

So, though many manufacturers now regard the problem from the standpoint of general plant efficiency, decrease of labour turnover, and improvement of industrial relations, there are still those whose attitude is merely "we are paying too much for insurance." With this latter type of employer the safety engineer has for his first job to convert the management. He must get them to accept the slogan "Safety before production", and to implement it by a promise of the necessary appropriations for remedying existing unsafe conditions. The superintendents will take their cue from the management, and from them the idea will filter down through the whole organization.

Having enlisted the whole-hearted support of the management, the next step is to form at each plant a central committee consisting of the superintendent and three or four of the senior foremen to dictate policy, and give decisions on the suggestions for safety proposed by the employees. At the first meeting of this committee the superintendent should submit a draft of a letter to be sent to every employee in the plant over his signature, stating that it is the desire of the company to make next month a *no accident month,* and appealing for his co-operation. A letter of this kind issued to employees at one of our plants read as follows:—

Dear Sir:—

At 7 o'clock on the morning of July 1st we are going to make a new start in our *Accident Prevention* work. I want to ask you to give us your earnest assistance in a campaign to go through the month of July without a single accident causing lost time.

Let's make July a "*No Accident*" month. Other Plants have done it. Why cannot we? Remember it is better to be careful and safe while doing your work than to suffer and be sorry after you have been injured.

Take no chances. Always follow the safe course and, if you see any of your fellow employees needlessly exposing themselves to danger, be sure to call the attention of your "*Safety Committee Man*" to their course and, by all means, point out to them why they are liable to be injured. They will appreciate your friendly interest, and you may save them from serious injury.

We are willing to do our part to make your job safe, but remember, we cannot possibly succeed unless you do your part. As you receive your brass check each day, resolve then and there that you will be careful. Do this every day and I believe we can make July a real "*No Accident*" month.

Yours for success,

There is abundant evidence that a letter of this kind is the right first step in interesting the employees at large in an accident prevention campaign. Personal letters from the superintendent of a plant are not frequently received by the rank and file of the employees, and those who cannot read English, keep the letter, and get someone to translate it for them, thinking generally that it may be notification of a shut-down or something unpleasant of that sort.

Simultaneously with the distribution of this letter, a start should be made on the preparation of a series of bulletins featuring the *no accident* month. A different bulletin should be provided for each day of the month, and bulletin boards set up in ten or more different locations about the plant. A blackboard bulletin near the check office can be used to chronicle progress from day to day, and local artists can device extempore pictures of accidents or hazards, to keep the men interested in the board. The National Safety Council of America provides a bulletin service for its members, and many useful pictorial posters can be obtained from them, but nothing really catches on as well as the home-made bulletin.

The next step is the foundation of mill committees consisting of about three members each, for each department or group of departments in the mill. These men work as inspection committees and report on dangerous conditions, and especially on dangerous practices, besides warning their fellow-workmen. They investigate all serious accidents, and near accidents, and submit reports and recommendations. A few days before the first of the month, a joint meeting of the central and mill committees should be held, an address being given by some safety engineer who can speak from experience of *no accident* month in other plants in the same industry. Weekly meetings of the safety committee comprising the mill committees, presided over by the local safety engineer or by a member of the central committee should be held during *no accident* month.

Experience has shown that in most cases there is a reduction of 60 to 75 per cent in accidents during *no accident* month, and in a group of half-a-dozen plants there are always one or two with a clear record for the month. In a recent campaign in my experience comprising eight plants of the Alpha Cement Company, five had a clear record for the month, and the other three totalled five accidents with 55 days lost. The previous year in the same month they had 32 accidents with 7 2 days lost.

Statistics

With regard to statistics of industrial accidents, neither in Canada nor in the United States are the figures available, reliable or complete. In the United States, according to the Labour Review there is no uniform method of tabulating statistics of accidents for the entire country, and few states can be said to have accurate knowledge of the total number of accidents occurring in the industries within their borders. About half the states have no classification of accidents to the industries affected, and very few analyze them by cause and severity.

There is an absence of uniformity in reporting laws and practices, and consequently incomplete reports from many states, and lack of uniform tabulation of data. Until uniform state legislation makes it compulsory for any employer of labour, large or small, to report his accidents on a standard form to the State Workmen's Compensation Board it will be impossible to arrive at the determination of accident rates, which is so necessary for effective accident prevention work. The National Safety Council which was formed in 1913 and now includes over 4,000 United States manufacturers in its membership, has done splendid work in the discussion and elimination of hazards in industry, and in popularizing safety work among its members and the public at large. The American Engineering Standards Committee is working on the preparation of a comprehensive set of safety codes for the guidance of state commissions. In the preparation of this "National Safety Code" the committee is securing assistance from the American Society of Safety Engineers which has elected code committees to discuss the various hazards and report. As far as the writer is aware, however, no advance has been made recently towards uniformity in the requirements of state compensation acts and workmen's compensation boards.

Compensation Boards in Canada

In Canada, the province of Quebec was the first in the field with a Workmen's Compensation Act in 1910, followed by Ontario in 1915, and by the other provinces later. However, Quebec balked at putting the administration of the Act in the hand of a commission although the other provinces did so. Exactly why a public utilities commission should be all right and a workmen's compensation commission all wrong, is a psychological question difficult to decide. The point of view is that under commission management the cost of administration would be excessive. But this is not the verdict of Ontario manufacturers, who are grouped in an Accident Prevention Association authorized under the Act. Their annual report for 1920 shows an average assessment of $1.25 per $100 of pay roll for all industries with a total pay roll of about 436 million dollars. Benefits under the Act were 7¾ million dollars including 2¼ million for retroactive pensions. Cost of administration of the Act was $125,000 of which $45,000, or about one-third, was paid to safety associations for accident prevention work. The number of workers protected amounts to about 350,000, so the administration cost of the Act is 36 cents for each man on the pay roll, including safety association charges.

An association of Workmen's Compensation Boards has already been formed, and as soon as Quebec comes into line, the statisticians of this association will be in a position to standardize the methods of accident reporting throughout Canada. Thereafter the hazards of each industry will be measureable, and the safety engineer will no longer be fighting in the dark for there will be a basis of comparison for the progress of every plant and every industry in the cause of accident prevention which is also the cause of humanity.

Report of Committee on Classification and Remuneration of Engineers

Published by authority of Council for the information of the members of The Institute with a view to discussion and consideration by Branches regarding its adoption by The Institute. The columns of The Journal are open for discussion by individual members.

The Council of 1920 approved of the establishing by The Institute of rates of remuneration for its members both by fee and by salary, it being added in a resolution "which rates The Institute will endeavour to uphold".

This report relates to the annual compensation of engineers and to the classification of those not in consulting practice. It has been received by Council, has already been referred in confidence to the Branch Executives, and is now being published on the authorization of Council for the information of the membership at large. It is anticipated that discussion on this report will take place in the various Branches during the coming months, and that every Branch will go on record as to the wishes of the Branch regarding its adoption by The Institute or otherwise. As indicated in the report, the second part, relating to fees for special work, particularly that of a consulting engineering nature, will be presented by the committee to Council at an early date. The whole subject is of the utmost importance to the engineering profession.

To the President and Members of Council,
The Engineering Institute of Canada:

The Committee was constituted by resolution of Council dated March 23, 1920. Progress reports have been submitted from time to time.

The report of your Committee is divided into two parts:

Part I — Relates to annual compensation.
Part II — Relates to fees for special work, particularly that of a consulting engineering nature.

The final report of Part I herewith is submitted. Part II will be prepared in the immediate future.

Your Committee, in preparing this report, has had before it the reports of the Toronto, Winnipeg, Vancouver, Saskatchewan, Quebec and Halifax Branches of *The Engineering Institute*, that of the British Columbia Technical Association, reports of certain of the societies of the United States, as well as that of Engineering Council of New York. It has also availed itself of the information to be obtained from time to time in the technical press. Full consideration has been given to the classification of the Dominion Government engineering and allied services made under the supervision of the Civil Service Commission of Canada.

Classification

Your Committee realizes that the first essential towards any concerted or general effort on the part of the engineering profession in Canada towards proper compensation for its services is a standardized classification with accompanying rates of remuneration. It has, therefore, been the main purpose of your Committee to evolve an appropriate classification and scale of remuneration. After a careful study of the several reports, that proposed by the Engineering Council recommends itself to your Committee and, with some alterations, has been adopted as the basis of this classification. The subdivision into professional and sub-professional service has been discarded as it was felt to be impossible to draw any marked distinction between them, and that there was no advantage in doing so. This required a certain revision of grades V, VI, and VII in regard to duties and qualifications. Another slight revision has been made to give the college graduate less advantage over the non-graduate with experience for the first year or so after graduation, and a greater advantage thereafter until the higher positions are reached. It is felt that for the higher positions a fixed difference in years of experience between the graduate and non-graduate is purely academic but the Engineering Council periods have been retained.

While the names attached by the Engineering Council to the different grades in the classification have been retained, it has been only for the purpose of identifying the different grades by association with a name; the name attached to an engineering position need not necessarily be an indication of the grade that would be accorded that position in this classification. The name of Chief Engineer of a small industrial concern or a small municipality might correspond to grade V or VI in the matter of duties and qualifications. It should be possible, however, from the nature of the duties required and the qualifications demanded for any position, to assign that position to its proper grade in the classification. The list of positions given corresponding to each grade is merely suggestive.

Chief Engineer: There are certain engineering positions of great importance which require men of the highest engineering ability and training and executive attainments and the occupants of such positions your Committee has given the title of Chief Engineer. Such positions are considered as being outside the scope of engineering classification.

The Classification prepared by your Committee is as follows:

Grade I—Assistant Chief Engineer

Duties — To act in administrative charge of a technical organization, or of a main division thereof; to determine the general policies of the organization under the limitations imposed by law, regulation or other fixed requirements; to have final responsibility for the prepara-

tion of reports, cost estimates, designs, and specifications and for the construction, maintenance, or operation of engineering works or projects; to have full charge of the collection and presentation of data for the conduct of valuation proceedings; to conduct or direct the most comprehensive lines of engineering research.

Qualifications — Training and experience of a character to give substantial evidence of engineering knowledge and ability or of executive capacity of highest order along lines of work similar to those involved in the position to be occupied and of at least twelve years' duration of which at least four years shall have been spent in work of a similar character in a subordinate position, and at least five years in responsible charge of important work or projects. Fundamental training equivalent to that represented by professional degree granted upon the completion of a standard course of engineering instruction in an educational institution of recognized standing, or, in the absence of such degree at least four years additional experience. The completion of each year of such standard course shall be considered the equivalent of one full year of such additional experience.

Positions corresponding to this Grade: Assistant Chief Engineer, City Engineer, Superintending Engineer for a Province, etc.

Grade II—Engineer

Duties — Under general administrative direction and within the limits of the general policies of the organization, to have responsible charge of and to initiate and determine policies for a major subdivision of an organization; to prepare for final executive action reports, cost estimates, designs, specifications, and valuation studies and data; to have immediate charge of the construction, maintenance or operation of engineering works or projects of major importance; to conduct or direct major lines of engineering research; or to furnish for execution action expert or critical advice on engineering works, projects or policies.

Qualifications — Active professional practice or executive charge of work for at least eight years, of a character to demonstrate a high degree of initiative and of ability in the administration, design, or construction of engineering works or projects of major importance, of which at least three years have been spent in work of a similar character in a subordinate position and at least three years in responsible charge of work. Fundamental training equivalent to that represented by professional degree granted upon the completion of a standard course of engineering instruction in an educational institution of recognized standing, or, in the absence of such degree, at least four years of additional experience. The completion of each full year of such standard course shall be considered the equivalent of one year of such additional experience.

Positions corresponding to this Grade: Engineer, District Engineer, Designing Engineer, etc.

Grade III—Senior Assistant Engineer

Duties — Under general administrative and technical direction to be in responsible charge of an intermediate division of an organization; to exercise independent engineering judgment and assume responsibility in studies and computations necessary for the preparation of reports; cost estimates, designs, specifications or valuations; to have immediate charge of the construction, maintenance or operation of important engineering works or projects; or to conduct or direct important lines of engineering research.

Qualifications — Active professional practice or executive charge of work for at least five years, of which at least three years shall have been spent in work of a similar character in a subordinate position, with at least one year in responsible charge of work. Fundamental training equivalent to that represented by professional degree granted upon the completion of a standard course of engineering instruction in an educational institution of recognized standing, or, in absence of such degree, at least five years of additional experience. The completion of each full year of such standard course shall be considered the equivalent of one year of such additional experience.

Positions corresponding to this Grade: Senior Assistant Engineer, Division Engineer, Engineer of a Department.

Grade IV—Assistant Engineer

Duties — Under specific administrative and technical direction, to be responsible for the conduct of the work of a minor subdivision of an organization, to collect and compile data for special items of engineering studies; to take immediate charge of field survey projects and of the design and construction of engineering work; to lay out and develop work from specifications and to supervise the work of draughting or computing force; or to conduct specific tests or investigations of apparatus, materials or processes.

Qualifications — Experience for at least three years of which one year shall have been spent in duties of a similar character in a subordinate position. Fundamental training equivalent to that represented by professional degree granted upon the completion of a standard course of engineering instruction in an educational institution of recognized standing, or, in absence of such degree, at least five years of additional experience. The completion of each full year of such standard course shall be considered the equivalent of one year of such additional experience.

Positions corresponding to this Grade: Assistant Engineer, Estimating Engineer, Chief Engineering Draughtsman, Engineer on Construction, etc.

Grade V—Junior Assistant Engineer

Duties — Under immediate supervision to take charge of squads in draughting office; to direct work of field party on surveys or construction; to direct the work of computing surveys, estimates; to design minor engineering works; to compute and compile data for reports or records; to investigate minor details of engineering work; to perform tests of apparatus, material or processes; to have charge of inspection of engineering works under construction.

Qualifications — Experience for at least two years in duties of a similar character in a subordinate position. Fundamental training equivalent to that represented by professional degree granted upon the completion of a standard course of engineering instruction in an educational institution of recognized standing, or, in absence of such degree, education equivalent to graduation from a high school and at least four years of additional experience. The completion of each full year of such standard

course shall be considered the equivalent of one year of such additional experience.

Positions corresponding to this Grade: Junior Assistant Engineer, Inspecting Engineer, etc.

Grade VI—Junior

Duties — To supervise the plotting of notes and maps, to perform work involving the use of surveying, measuring and draughting instruments; to take charge of parties on survey or construction work; to design details from sketches and specifications; to compute and compile data for reports or records; to inspect or investigate minor details of engineering work; to supervise construction or repair work; to check plans, surveys and other engineering data.

Qualifications — Experience for at least one year in work of a similar nature in a subordinate position. Fundamental training equivalent to that represented by a professional degree granted upon the completion of a standard course of engineering instruction in an educational institution of recognized standing, or, in the absence of such degree, education equivalent to graduation from a high school and at least three years of additional experience. The completion of each full year of such standard course shall be considered the equivalent of one year of such additional experience.

Positions corresponding to this Grade: Senior Draughtsman, Inspector, etc.

Grade VII—Senior Aid

Duties — To prepare general working drawings where design is furnished; to plot notes and prepare maps; to design simple structures; to make computations and compile data for reports and records, to prepare routine tests of apparatus or materials, to run surveying instruments and to adjust and care for same; to compute surveys and estimates; to make minor engineering computations; to inspect incidentally construction or repair work.

Qualifications — Experience for at least two years in work of a nature to qualify for this grade. Education equivalent to graduation from a high school and familiarity with the use of the slide rule and of logarithmic and other simple mathematical tables. The completion of each full year of a standard course in an educational institution of recognized standing shall be considered as the equivalent of one year of the experience otherwise required.

Positions corresponding to this Grade: Draughtsman, Leveller, Transitman, etc.

Grade VIII—Junior Aid

Duties — To trace and letter maps and plans; to make simple drawings from sketches and data; to make minor calculations; to run tape or levelling rod; to perform other miscellaneous subordinate duties in survey party in field or office, as directed.

Qualifications — Education equivalent to graduation from a high school.

Positions corresponding to this Grade: Tracer, Chainman, Rodman, etc.

Remuneration

In arriving at a scale of remuneration, your Committee has paid particular attention to the report of the Branches of *The Engineering Institute* as representing the opinion of the members of *The Institute* throughout Canada as to what would be a reasonable rate of compensation for engineering services in salaried positions. These reports show a very wide range in the salaries proposed, especially in the higher grades and the variation does not appear to be a question of location or the section of the country in which the report was made. The difference of opinion of different groups of men is very well exemplified by the report of the Vancouver Branch where the scale of remuneration proposed by a committee appointed by the Branch was raised from fifteen to twenty per cent, for the intermediate grades at a general meeting of the Branch.

In this report no attempt is made to give different salary schedules for different services such as "Railroad", "Municipal" or "Industrial". Duties of the same nature, or work of the same grade should command the same remuneration, other conditions being the same, whether the work is being done in the service of a railroad, a municipality or an industrial concern. The range between minimum and maximum in the salaries suggested allows latitude for the difference in the abilities of occupants of the same position in the lower and intermediate grades. Your Committee feels that it would not be warranted in suggesting salaries for the higher grades beyond stating what it thinks to be a reasonable minimum.

While the rates of remuneration proposed in this report may seem too low to many of the members of *The Institute*, your Committee felt that it would be advisable to be moderate in the first scale, that there would be danger of defeating the object for which the schedule is designed if too high a rate were proposed. Demands to an employer which to him seem unreasonable will receive but slight consideration. Nor can there be any hope of making a schedule effective if it is so high that many of the members of the profession who are not members of *The Institute* would be satisfied to accept positions at a lower salary than that proposed by the schedule.

On the other hand your Committee is of the opinion that the salary ranges for the different engineering positions in the Dominion Government service are inadequate for the professional qualifications exacted. It would seem that adjustments should be made either to give higher salary ranges for the present specifications, or reduced qualifications for the present salary ranges if it desired to attract and retain a staff of properly qualified engineers in the Government service.

The following table gives the grade, years of experience, with and without a college degree and the proposed minimum and maximum salaries for each grade:—

Grade	Title	Years with degree	Years without degree	Salary Range Min.	Max.
VIII	Junior Aid	0	0	600	1,200
VII	Senior Aid	0	2	1,200	1,800
VI	Junior	1	4	1,800	2,400
V	Junior Asst. Eng.	2	6	2,400	3,300
IV	Asst. Eng.	3	8	3,300	4,200
III	Senior Asst. Eng.	5	10	4,200	5,400
II	Engineer	8	12	5,400	no limit
I	Asst. Chief Eng.	12	16	7,200	no limit

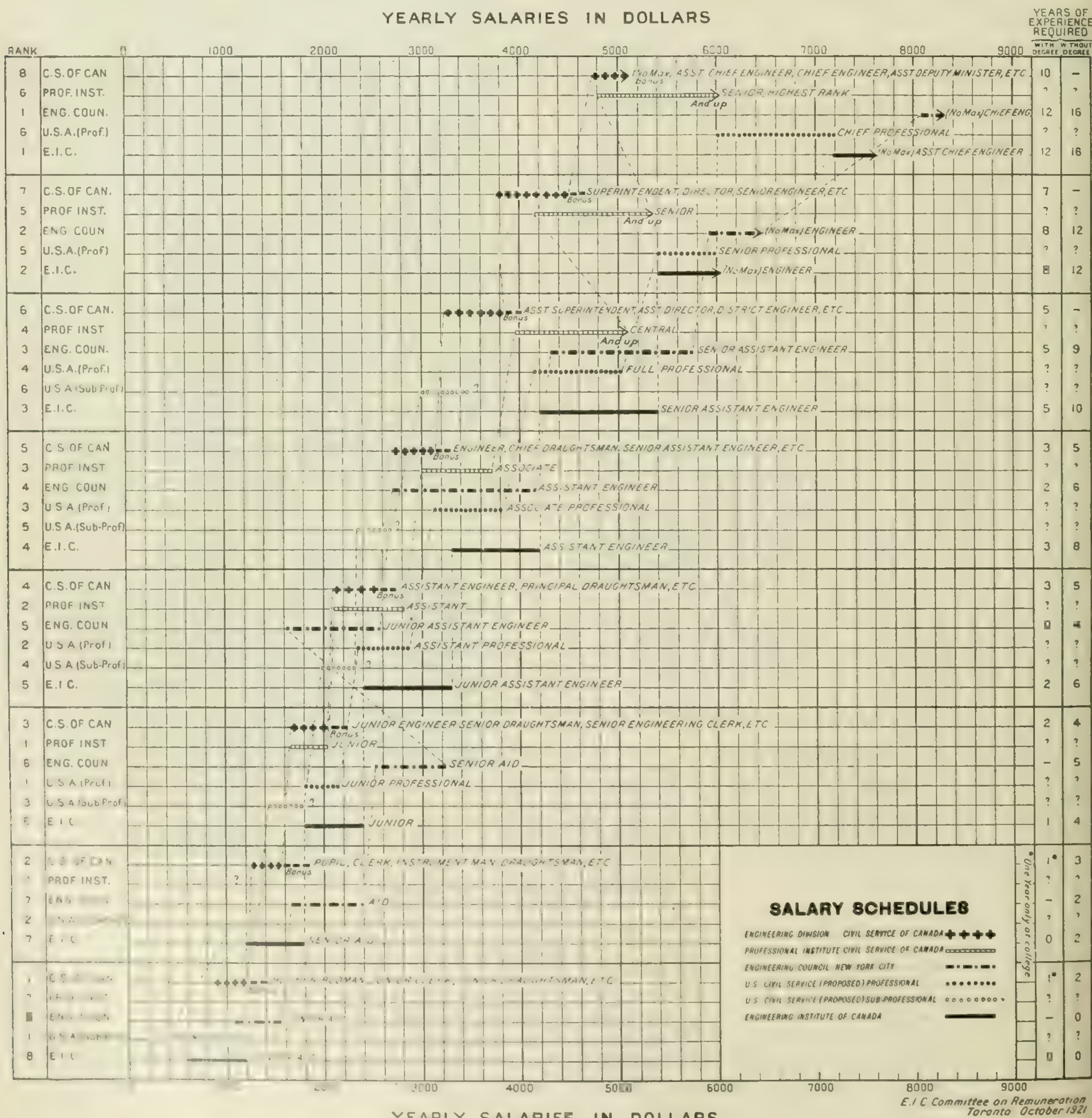
What steps *The Engineering Institute* may take to put this or any other scheme of Classification and Remuneration into effect is not within the scope of this Committee to advise. It is the opinion of the Committee, however, that the larger part of any material improvement must come from the action of the members of the profession themselves. The value the individual member of the profession places upon his services and the remuneration he insists upon obtaining, must, in the long run, be the greatest factor in bringing about a financial improvement in the profession. It is hoped by your Committee, that this report will set an equitable standard for that value, and will be a guide to the members of the profession so that there may be some uniformity in regard to the remuneration asked for the performance of duties of a similar character.

Respectfully submitted,

A. H. HARKNESS, *Chairman.*

Personnel of Committee:—

Chairman, A. H. Harkness, M.E.I.C., Consulting Engineer, Toronto.
Secretary, Frederick B. Brown, M.E.I.C., Consulting Engineer, Montreal.
J. B. Challies, M.E.I.C., Director of Water Power, Dept. of the Interior, Ottawa.
A. R. Decary, M.E.I.C. Superintending Engineer, Prov. of Quebec.
E. R. Gray, A.M.E.I.C., City Engineer, Hamilton, Ont.



Address Wanted

With the compilation of the 1923 Year-Book about to commence and for purposes of general record it is necessary to locate if possible those members whose addresses are not known. Any information regarding the addresses of members on the list printed below will be greatly appreciated by the Secretary.

Members

Aiken, Major A. B.,
Allison, John Logie,
George, F. J.,
MacDonald, Charles, LL.D.,
MacLachlan, J. S.,
Macpherson, Osborne Cluny, (Lieut.),
♂Naish, T. E., (Major),
Ord, L. R.,
Press, William Joseph,

Associate Members

♂Adam, William Alexander, (Capt. M.C.)
♂Adamson, Ernest Kinnear,
Bare, Henry St. John,
Bell, Charles Burnby,
♂Bishop, Reginald W.,
Black, Mogens,
Bourgoing, Sylvio,
♂Bowie, James,
♂Butler, Geo. A.,
♂Caddell, William Persse, (Capt.),
Carlyle, Russell,
Coltman, Walter J.,
♂de Lestang, John M.,
Flood, John Garner,
Goodman, Norbert,
Gorrie, David Francis,
♂Hamilton, George M., (Lieut.),
Hay, William Wren,
Helyer, Maurice,
♂Herren, P. H.,
♂Hodgson, H. M. T.,
Jamieson, Wm. T.,
King, John L.,
Kinnear, Clifford R.,
Mackay, Angus G.,
♂MacKenzie, John A., (Major),
♂MacLachlan, Jas. B., (Lieut.),
♂MacLennan, Alex L., (Capt.),
Marshall, John,
Martin, Louis A.,
McDiarmid, S. S.
McDougall, Alex. L.,
McLean, John Rose, (Lieut.),
Melanson, Hector W.,
Milne, J. E.,
Moffat, Frank P.,
♂Muirhead, Thos., (Lieut.),
Newton, C. A.,
Nowlan, Arthur,
♂Oborn, Stanley Mill,
O'Connor, J. F.,
♂O'Leary, H. Gordon,
Pardoe, Henry M., (Major R.E.),
♂Patrick, K. S.,
Peck, Orwin K.,
Pinch, H. H.,
♂Reid, A. C.,
Rodd, Brent T.,
♂Simpson, Rupert, (Capt.),
♂Smith, A. Parker, (Capt.),
♂Sohier, Raymond,
♂Stavert, Wm. D., (Lieut.),
Stewart, J. Crossley, (Lt.-Col.),
Tilston, John Arthur,
Turner, Stanley Roy,
Wakefield, John Albert,
♂Walker, T. Molineux, (Capt.),
Zverina, Jan.

Juniors

Bathen, Johan,
♂Booth, Chas. D. G.,
♂Brown, Harold Lawson,
Bryant, Earlham,
Calkins, H. A.,
♂Campbell, Walter I. H.,
Burton, E. C.,
♂Clark, Chas. Reginald,
♂Clendinning, James,
♂Dansereau, Jos. Adolphe,
♂deCardillac, Galliot,
♂Draper, Walter H.,
♂Fairn, A. S., (Capt.),
♂Greening, Edward O.,
Hamilton, John Raymond,
Hughes, Hamilton Cleaver,
♂Jones, John Henry,
♂Junkin, R. L., (Capt. M.C.),
Lacroix, Pecci A.,
Lamb, G. J.,
Leger, Alcibiade,
♂McNeil, Orange M., (Lieut.),
♂Mitchell, J. Cameron, (Capt.),
♂Moxon, G. B.,
Penney, Edgar, (Capt.),
♂Stewart, Henry W.,
Tempest, Frank,
♂Tippet, H. Jackson,
Vogan, Geo. O.,
♂Wetmore, Fred. W. C.,
♂Willrich, Edgar G., (Lieut.),

Students

Abel, John S.,
Abernethy, W. W.,
♂Adlard, L. S., (Capt.),
♂Anderson, A. C.,
Barnes, Frank Harvey,
♂Bayne, Chas. MacV.,
Bell, W. Thos. A.,
Bennett, W. E., Jr.,
♂Cameron, Geo. D. W.,
Carnahan, E. H.,
Cassidy, I. B.,
Cromwell, H. Roy,
♂Dawson, John Kenneth,
Delaney, Wm. Victor,
♂De Paul, M. J.,
Deschamps, A.,
Desmaisons, O.,
♂Dickson, Wm. J.,
Doucette, Andrew L.,
♂Dunlap, H. J.,
Dunlop, P. J.,
Farncomb, H. F.,
♂Fessenden, Chas. V., (Lieut.),
Filteau, J. N. L.,
♂Fowlds, E. S.,
♂Gagnier, Oliver Jos.,
♂Gagnon, Ernest,
♂Glanville, J. C.,
Glave, Ralph B.,
♂Graham, D. S., (Lieut.),
Grant, W. R.,
Guenther, Wm. Frank,
Haley, Jos. Patrick,
♂Hammer-Schou, J., (Capt.),
Hendershot, Rolphe W.,
♂Hewson, John Henry,
♂Howes, Fred. S.,
Hudsen, Geo. W.,
♂Hunter, W. H., Jr., (Lieut.),
♂Jaffary, Jas. H. E.,
James, Victor A.,
♂Jepson, Thos.
Kennedy, Chas. Lawrence,
Kennedy, T. W.,
Koen, Jas. D.,
Laurin, Jas. E.,
♂Lindsay, Roy Eli,
Logan, Wm. Hector,
Loignon, B.,
♂Macheras, Jos. P.,
♂Macpherson, H. E.,
Martin, Berchmans, E.,
McCallum, Fred. Lee,
♂McDonald, J. N.,
♂McInnes, Wm. Arthur,
♂McIntosh, Wm. Lyon,
Methe, L. P.,
♂Mignault, L.,
♂Murray, Jas.,
Noonan, Wm. H.,
♂Plant, Wm. A.,
Potter, John B.,
Pym, J. S.,
Rousell, Frank,
♂Ryan, Charles C.,
♂Scott, Morris Alex., (Lieut.)
♂Seymour, Edgar R. W.,
♂Shannon, Robert Eric.,
Sharpe, Clarence B.,
♂Sime, A. W.,
Spence, Wm. Arch.,
♂Stalker, D. A.,
♂Staples, Grenville Jas.,
♂Stewart, Andrew E.,
♂Sutherland, Dan M.,
Toole, Francis James,
Vanier, George,
♂Williscroft, G. M.,
♂Wilson, A. L.,
♂Woollatt, D. H., (Lieut.),
Yates, Bert Thomas,

Associate

McGuire, F. C.

Note: Overseas sign indicates members from whom The Institute has had no definite word and no address since the war.

THE

ENGINEERING JOURNAL

THE JOURNAL OF
THE ENGINEERING INSTITUTE
OF CANADA

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Nominations for Officers' Ballot

Within seven days after the first meeting of the Council in October, the Secretary shall mail to each corporate member of The Institute *the officers' ballot, as prepared by the Nominating Committee and the Council.*

Notices shall be deemed to have been mailed to members as prescribed by the By-Laws if such notices are printed in The Journal of The Institute *and mailed by the dates prescribed in the By-Laws.*

The following is a list of the nominees submitted by the Nominating Committee, as required by the By-Laws before the first day of October, and as approved by Council at the regular meeting of Council held on October twenty-fourth:—

President: Arthur St. Laurent, M.E.I.C.; Ottawa, Ont, proposed by Council.

Vice-Presidents: J. B. Challies, M.E.I.C., Ottawa; Geo. W. Craig, M.E.I.C., Calgary; Walter J. Francis, M.E.I.C., Montreal; J. H. Hunter, A.M.E.I.C., Montreal, proposed by Nominating Committee; Major Geo. A. Walkem, M.E.I.C., Vancouver, proposed by Council.

Councillors: District No. 1: Frederick B. Brown, M.E.I.C., Montreal; Col. Arthur E. Dubuc, M.E.I.C., Montreal; C. M. McKergow, M.E.I.C., Montreal; W. H. Winterrowd, A.M.E.I.C., Montreal.

District No. 2: W. D. Baillairge, M.E.I.C., Quebec; A. R. Decary, M.E.I.C., Quebec.

District No. 3: Geo. D. Macdougall, M.E.I.C., New Glasgow; J. D. McBeath, M.E.I.C., Moncton; Frank P. Vaughan, M.E.I.C., St. John.

District No. 4: K. M. Cameron, M.E.I.C., Ottawa; C. P. Edwards, A.M.E.I.C., Ottawa.

District No. 5: W. L. Barns, A.M.E.I.C., Peterborough; Geo. T. Clark, A.M.E.I.C., Toronto; R. L. Dobbin, M.E.I.C., Peterborough.

District No. 6: L. McGill Allan, A.M.E.I.C., Windsor, proposed by Nominating Committee; A. J. M. Bowman, A.M.E.I.C., Windsor, proposed by Nominating Committee; H. B. R. Craig, M.E.I.C., London, proposed by Council; Dr. Geo. F. Porter, M.E.I.C., Windsor, proposed by Council; Frank E. Sterns, A.M.E.I.C., St. Catharines, proposed by Nominating Committee.

District No. 7: E. P. Fetherstonhaugh, M.E.I.C., Winnipeg; Geo. L. Guy, M.E.I.C., Winnipeg.

District No. 8: R. N. Blackburn, M.E.I.C., Regina; L. A. Thornton, M.E.I.C., Regina.

District No, 9: P. Turner Bone, M.E.I.C., Calgary; B. L. Thorne, M.E.I.C., Calgary.

District No. 10: Chas. Brakenridge, M.E.I.C., Vancouver; P. Philip, M.E.I.C., Victoria.

The Policy Committee's Recommendations

Since the publication of the report of the Committee on Policy, in the June number of *The Engineering Journal*, considerable progress has been made in carrying out its recommendations. In general, they divide themselves into those which involve constitutional changes, and those which can be carried out under present by-laws.

With regard to the constitutional changes, the Legislation and By-laws Committee of Council is now engaged upon the preparation of the necessary by-law amendments covering the following matters:—

(1) **The broadening of the Institute's stated objectives.**

(2) **Such internal economy changes as will strengthen the Branches and enable them to articulate more directly with Council, the governing body of the Institute.**

(3) **The making of Council more continuously representative of those centres of Institute activity which do not, on account of distance from headquarters, function directly.**

(4) The payment of mileage to Councillors upon a reasonable basis and within the available income of the Institute.

(5) More generous and general distribution of the high office of Vice-President, with concurrent extension of its usefulness.

It will be readily understood that these recommendations involve fundamental changes of far-reaching importance. Nevertheless Council is determined that they shall be given effect with the least possible delay consistent with the procedure imposed by the present constitution. Changes in by-laws must be discussed at an Annual General Meeting, and then within two months submitted by letter ballot for a mandate of the corporate members.

As the Policy Committee's recommendations have been formally endorsed at two General Professional Meetings, one at Vancouver in June, and one at Winnipeg in September, Council expects that the necessary two-thirds majority will be given the constitutional changes when the ballot vote is recorded.

With regard to the committee's recommendations which do not involve constitutional changes, Council has already:—

(a) Provided for more effective co-operation with sister bodies in Canada and the United States by initiating action through regular channels.

(b) Recognized the basic importance of the engineering educational facilities of the Dominion to the future of both the country and the profession by the appointment of a strong special committee consisting of Messrs. Geo. R. MacLeod, M.E.I.C., chairman, Arthur Surveyer, M.E.I.C., F. P. Shearwood, M.E.I.C., T. R. Loudon, M.E.I.C., A. M. Reid, S.E.I.C., and R. W. Downie, A.M.E.I.C., to take appropriate action to link up the Institute and its facilities with the students in engineering in all Canadian institutions of learning.

(c) Initiated suitable action to secure academic recognition for the engineering profession comparable to that extended to the sister professions of law and medicine by the governing and degree-conferring bodies of our Canadian universities. This is in the hands of a special committee consisting of Vice-President A. Surveyer, M.E.I.C., as chairman; with the chairman of the Committee on Policy, J. B. Challies, M.E.I.C., and the Deans of the Faculty of Applied Science and Engineering of McGill, Toronto and Queens; Dr. F. D. Adams, HON. M.E.I.C., Brig. General C. H. Mitchell, LLD., M.E.I.C., and Dr. A. L. Clark, HON. M.E.I.C.

(d) Referred the duty of analyzing the Institute's Code of Ethics so that it may be more of a positive influence for a broader and a better professional consciousness, to a special committee consisting of Messrs. Arthur Surveyer, M.E.I.C., chairman, F. P. Shearwood, M.E.I.C., and Frederick B. Brown, M.E.I.C.

(e) Taken positive action to secure adequate and just remuneration for engineers, especially the younger members of the profession, by ordering the immediate publication of the progress report of the special Committee on Remuneration.

By every means within its power and with the least possible delay, Council is endeavouring to implement the Policy Committee's recommendations.

Engineer Heads Government Railways

During the past decade the engineering profession has gained considerable prestige from the fact that engineers of eminence have forged to the front with the various transportation systems of the continent and are to-day occupying high executive positions for which they are well qualified. The announcement by the federal government of the appointment of Sir Henry Worth Thornton, K.B.E., an outstanding engineer, as president of the Canadian National Railways system, was noted by members of the profession throughout Canada with no small satisfaction, although it is realized that the position, hampered as it must be to some extent at least, by politics, involves difficulties and problems which only a superman can meet and satisfactorily solve. In spite of his ability and experience, if Sir Henry Thornton is not permitted similar freedom of action to that enjoyed by the president of a private corporation, his genius must be great indeed if he is to achieve outstanding results. In his efforts to accomplish the desired ends he will have the sympathetic interest of his fellow engineers throughout the Dominion.

Sir Henry Worth Thornton, K.B.E., was born at Logansport, Indiana, in November, 1871, and graduated from the department of civil engineering of the University of Pennsylvania with the degree of Bachelor of Science in 1894. After graduation he obtained employment with the Pennsylvania Railroad Company and through various positions of advancement to that of superintendent of Long Island Railroad in 1911, which is part of the Pennsylvania Railroad System. In April 1914 he was called to England as general manager of the Eastern Railway Company which enjoys the largest passenger traffic of any railway in the world, the company operating a line of steamships and operating hotels and dining car services. During the war he was made a member of the executive committee of general managers which, under the direction of the government, controlled and worked all the English railways. In 1916 he became deputy director of inland water transportation with the rank of Colonel in the Royal Engineers, which department handled all the inland navigation in Northern France, Egypt and Mesopotamia.

In 1917 Sir Henry went to Paris as assistant director-general of movements of the railways, representing the director-general of the army council in negotiations with the French, Italian and American governments relating to transportation. In December of the same year he was made deputy director-general of the movements of railways with the rank of Brigadier-General and in 1918 was made inspector general of transportation on the continent. Sir Henry was naturalized as a British subject in March, 1919, and in May of the same year was gazetted a Knight Commander of the Order of the British Empire. He is also a Commander of the Legion of Honour of France, an officer of the Order of Leopold of the Belgians, and a holder of the Distinguished Service Medal conferred by the American government.

OBITUARIES

Alan Timbrell, A.M.E.I.C.

News of the death of Alan Timbrell, A.M.E.I.C., which occurred early Tuesday morning, October 3rd, at Simcoe, Ontario, after a short illness, has been received with deep regret by his many friends in *The Institute* as well as in private life. For the past two years the late Mr. Timbrell had been connected with the engineering service of the Ontario Department of Public Highways, and it was while on this work at Simcoe that he was suddenly stricken with pleuro-pneumonia which resulted in his death.

Mr. Timbrell, was born in India in 1877; his father, the late Colonel Thomas Timbrell, of Tavistock, England, being attached to the Indian forces. He received his early education at Christs Hospital, London, England, and Blundells School, England, and later was successful in all examinations for Fellowship of the Surveyors Institute of London, England. In 1895 he was articled for five years with a firm of mining engineers, land agents and surveyors, in Sheffield, England, and for three years following he was in charge of road construction in England. In 1904 Mr. Timbrell came to Canada and was for a number of years engaged on railway work on the engineering staff of the Transcontinental Railway and Hudson's Bay Railway resigning his position at the outbreak of war in 1914 to go overseas with the Canadian Engineers, with which he served continuously throughout the war. Upon returning to Canada after the signing of the armistice he became connected with the work on which he was employed at the time of his death.

Henry Percy Borden, B.SC., M.E.I.C.

Following an extended illness Henry Percy Borden, B.SC., M.E.I.C., died at his residence at Rockcliffe, Ottawa, on Thursday, October 19th, the news of which will be received with regret by a wide circle of intimate friends and acquaintances throughout Canada, particularly among the profession of which he was a popular and successful member. The late Mr. Borden was born at Port La Tour, Nova Scotia, on December 8th, 1872. He attended Mount Allison University, Sackville, N.B., and later graduated in civil engineering from the faculty of applied science, McGill University in 1902. Following graduation he was employed in the bridge department of the Canadian Pacific Railway, his work dealing with designing of bridges and masonry shop and field inspection, general inspection and the making of reports. In 1904 he was appointed assistant chief engineer of the Locomotive and Machine Company of Montreal, in charge of designing and sales department, in the structural branch. In 1906 he returned to the Canadian Pacific Railway as architectural engineer in charge of designing of steel and reinforced concrete work for that department. In 1908 he was appointed to the staff of the Quebec Bridge Commission as assistant engineer and in 1915 was made assistant to the chief engineer. The following year he was appointed a member of the board of engineers, Quebec bridge, which position he held until the completion of that work in 1918. Following the construction of the Quebec bridge Mr. Borden was retained by the department of railways and canals in a consulting capacity until last year. Later he opened

HENRY PERCY BORDEN, B.A.Sc., M.E.I.C.

an office in Ottawa as a consulting engineer specializing in bridges and structures of steel and reinforced concrete.

The late Mr. Borden was married in 1906 to Edith Eva Hall of L'Orignal, Ontario, who survives him with two daughters. Besides being a member of *The Engineering Institute of Canada*, he was a member of the American Society of Civil Engineers, and the Rideau, Country, and Royal Ottawa Golf Clubs, Ottawa.

Charles Priam Loveland, A.M.E.I.C.

Charles Priam Loveland, A.M.E.I.C., died suddenly at his residence, 36 Sussex Avenue, Montreal, on Thursday evening, October 20th, as a result of a hemorrhage of the lungs. Although the late Mr. Loveland had been ill for the past three years his condition had appeared to be improving until the end came suddenly. Born at Bangor, Maine, on October 18th, 1871, the late Mr. Loveland was educated in Boston, commencing his engineering career with W. C. Bates, C.E., Jamaica Plain, Mass. In 1901 he entered the employ of the Boston Transit Commission as engineering assistant on construction of East Boston Tunnel, continuing in that position until 1907. In December 1907 he was made chief engineer for P. McGovern, contractor, of Boston, on conduit construction, Montreal Water Works. Since then he has continued residence in Montreal later becoming associated with the Leahy Construction Company of which he was president. He was also president of the Great Lakes and Atlantic Canal Power Company and was associated with the J. W. Harris Manufacturing Company, Limited. The late Mr. Loveland is survived by his wife and three sons, all of Montreal. He was elected to associate membership on April 9th, 1910.

PERSONALS

Noël F. Harrison, A.M.E.I.C., has just returned from a trip to Great Britain and Ireland and is now located at Winnipeg, Manitoba.

K. M. Chadwick, A.M.E.I.C., formerly assistant engineer with the Victoria Gas Company is now on a six months trip to the Old Country.

J. S. Macleod, A.M.E.I.C., has been transferred from assistant engineer on the Trent canal to assistant engineer on the Ontario-St.Lawrence canals.

A. W. Hanks, Jr.E.I.C., is now located with the Dominion Bridge Company, Limited, at Lachine, Quebec, coming from the Winnipeg office of the same company.

George Phillips, A.M.E.I.C., has been transferred from the department of Naval Service at Ottawa, Ontario, to H.M.C. Dockyard at Esquimalt, B.C.

George F. Bryant, S.E.I.C., who received his degree of B.A.Sc. in electrical engineering from the University of Toronto, this spring, is now with the Standard Underground Cable Company, Hamilton, Ontario.

Kenneth C. Cairns, S.E.I.C., of Fredericton, New Brunswick, who graduated in electrical engineering from the University of New Brunswick, last May, is now with the New Brunswick Electric Power Commission.

L. N. Jenssen, M.E.I.C., is now located at Warren, Idaho, as resident engineer for Alexander Potter, M.E.I.C., of New York, in connection with work for the Unity Goldmining Company.

E. D. W. Courtice, A.M.E.I.C., has discontinued his private practice as architect and engineer to take charge of the mechanical and architectural drawing at the Hamilton Technical School.

F. H. Kitto, D.L.S., M.E.I.C. exploratory engineer, Natural Resources Intelligence Branch, Department of Interior, has returned to Ottawa after spending the summer on investigation in Nova Scotia.

While in the west recently on an inspection trip A. St. Laurent, M.E.I.C., chief engineer of the Department of Public Works, was the guest of honour at a dinner given by his engineering friends in Vancouver.

J. P. Young, S.E.I.C., of Owen Sound, Ontario, who graduated this year in mechanical engineering at Queen's University, has been transferred by the firm of The Herbert Morris Crane and Hoist Company, from Niagara Falls, Ontario, to Toronto.

H. E. Howden, S.E.I.C., of Caledonia, Ontario, who graduated in electrical engineering at University of Toronto, this year, is now taking the graduate students course with the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.

H. M. Bigwood, A.M.E.I.C., secretary of the Victoria Branch, is just recovering from a motor accident in which he unfortunately sustained injuries to his right arm, which was fractured below the elbow, and also the dislocation of his wrist.

Peter Emslie, A.M.E.I.C., formerly resident engineer in charge of erection of a cotton mill at St. Hyacinthe and power-plant installation in Montreal, for J. M. Robertson, M.E.I.C., consulting engineer, is now located with Currie and Company, Edinburgh, Scotland.

James P. Gordon, A.M.E.I.C., who graduated from the University of Toronto in 1904, and who was for some years resident engineer for Chipman and Power, consulting engineers, Toronto, on waterworks and sewers, has accepted a position with the engineering department of the city of Hamilton.

J. A. McNichol, M.E.I.C., is now with the Toronto Transportation Commission. Before coming to Toronto he was connected with the construction department of the Canadian Pacific Railway at Winnipeg, as resident engineer.

D. M. Mawhinney, A.M.E.I.C., formerly resident engineer under the Manitoba Good Roads Board, at Stonewall, Manitoba, and more recently engineer on paving construction, in Itasca County, Minnesota, has been appointed resident engineer, with the Minnesota Highway Department with headquarters at Lake Benton, Minnesota.

Lt.-Commander C. P. Edwards, A.M.E.I.C., director of the Radio Branch of the Department of Marine and Fisheries, sailed for England on October 20th, to assist the Hon. E. Lapointe, Minister of Marine and Fisheries, in a conference with the Imperial authorities regarding the Imperial chain of high-power radio stations throughout the Empire.

John R. Dunbar, S.E.I.C., of Ottawa, who graduated in electrical engineering at McGill University last spring is now taking the graduate students course at the Massachusetts Institute of Technology. After graduation Mr. Dunbar was with the Geodetic Survey at Truro and later with the engineering department of the Canadian Westinghouse Company, Limited, Hamilton.

L. W. Gill, A.M.E.I.C., graduate of McGill University, who until recently has been in the department of mechanical engineering, University of British Columbia, is now with the Hamilton Technical School, Hamilton, Ontario. Before going to British Columbia, Mr. Gill was professor of electrical engineering at Queen's University, Kingston, and was responsible for the design of the heating and electric plant of that university.

C. V. Von Abo, Ph.D., Jr.E.I.C., received the degree of Doctor of Philosophy from McGill University at the recent convocation, having presented to the Graduate School of McGill, a thesis of exceptional interest on "The present status of our knowledge of secondary stresses in bridges". Dr. Von Abo received his degrees of B.Sc., and M.A., from Cape Town University in 1917 and 1919 respectively.

As a contribution to the relief of Northern Ontario conditions, the firm of Frank Barber and Associates, Limited, have offered to the Government their services and advice in rehabilitation. This offer, submitted through the Government, has been accepted by Mayor LeHeup of Haileybury, and Horace L. Seymour, A.M.E.I.C., town planning engineer of the firm, left for Haileybury on October 12th. While employed on town planning work with the Dominion Government, Mr. Seymour was

engaged in the replanning of the devastated area of Halifax after the explosion there in 1917. He, therefore, goes with experience that is invaluable in the present circumstances.

J. D. Craig, M.E.I.C., who went into the Arctic regions in Canada's interests this season as officer in charge of the expedition sent north by the Department of the Interior on the C.G.S. "Arctic", reports an interesting and successful trip. It is hoped shortly to be able to have for our readers an article covering the trip. L. O. Brown, of the Geodetic Survey staff, accompanied the expedition as surveyor and meteorologist, and Thos. P. Reilly, of the International Boundary Surveys staff, was assistant surveyor. Major R. A. Logan, D.L.S., who was in charge of the ground instructional school at Camp Borden, represented the Air Board, and will report on the possibilities of aviation in the north.

Philip J. Duff, A.M.E.I.C., has recently been elected a member of the Institution of Mechanical Engineers in London. Mr. Duff is now a partner in Alkin and Duff Engineering Company, D5 Clive Buildings, Calcutta, India. Mr. Duff was for many years in Canada on design and construction of pulp and paper mills and other engineering developments. For two and a half years he was resident engineer on the construction of the new Ransome Drifting Sand Filtration plant supplied to the city of Toronto by the Ver Mehr Engineering Co., and during 1917 and 1918 was associated with the Imperial Ministry of Munitions as inspector in charge of graze fuses in Canada.

William S. Wilson, A.M.E.I.C., is now engaged on investigation work with Walter J. Francis, M.E.I.C. Since graduating from McGill University in 1907 he has been engaged with the Tagona Water and Light Company, and Lake Superior Power Company in various capacities, also with the Algoma Steel Corporation, Limited, since 1913. While with the latter company he held various important positions on construction of timber pile docks; inspection of foundations and progress on blast furnace construction and sewers; complicated land surveys; surveys and the preparation of plans in connection with right-of-way purchases; quarry developments studies; land records; maintenance of office buildings and houses; heating plant and fuel conservation studies.

Major L. A. Wilmot, A.M.E.I.C., formerly of Brantford, Ontario, is with the department of Customs and Excise as investigator of values, in London, England. Major Wilmot is an honour graduate of the Royal Military College, Kingston, and received his degree of civil engineer from the University of Wisconsin. For a number of years he has been closely connected with hydro-electric development in Canada having been with the British Columbia Electric Railway as assistant engineer; the Jordan River hydro-electric development, Vancouver Island; assistant engineer with the Western Canada Power Company at Vancouver, B.C.; inspector for the Canadian Light Heat and Power Company at Valleyfield, Quebec, and assistant engineer with the Pacific Great Eastern Development Company.

Colonel J. Houliston, D.S.O., A.M.E.I.C., who has lately been appointed temporary Colonel Commandant of Military District No. 7 with headquarters at St. John, N.B., graduated from the R.M.C., in 1890, and received his commission in the Royal Canadian Engineers in July 1904. He went overseas in May 1915 and was for a time in charge of training at the Canadian Engineers Depot in England. Proceeding to France in February 1917 he was appointed assistant to C.E. Canadian Corps. In April of that year he took over command of the engineers of the 3rd Canadian Division, holding the appointment until July 1918 when he became C.R.E. Canadian Corps Troops. He was awarded the D.S.O. and twice mentioned in despatches. He now vacates the position of director of engineer services on the staff at Militia Headquarters.

New Honorary Member

A. L. CLARK, Ph.D., BSc.,
Hon. M.E.I.C. Dean of the Faculty of Applied Science of Queens University.

At the September meeting of Council, A. L. Clark, PH.D., D.SC., was elected an Honorary Member of *The Institute*. Dr. Clark was born at Worcester, Mass., U.S.A., and received his degree of Bachelor of Science from the Worcester Polytechnic Institute in the year 1894, and his degree of Doctor of Philosophy from Clark University in 1905. Following graduation from Worcester Polytechnic Institute Dr. Clark was engaged for some time in charge of the construction of the plant and mains for the New Rochelle Gas and Fuel Company, New Rochelle, N.Y. In 1906 he was appointed professor of physics in Queen's University and in October, 1920, Dean of the Faculty of Applied Science in the same university. Dr. Clark has been connected with *The Institute* for a number of years as an Associate, besides which he is a member of the American Physical Society; Société Française de Physique; Association Internationale du Froid; American Society of Refrigerating Engineers, and a fellow of the Royal Society of Canada.

Vice-President and General Manager of National Lines.

S. J. Hungerford, M.E.I.C., who has been appointed vice-president and general manager of the Canadian National Railway system, was born near Bedford, Que., in 1872, and commenced his railway work in 1886 as machinist apprentice with the Southeastern Railway and Canadian Pacific Railway, at Farnham, Que., where he worked for five years. For the following three and one-half years he was machinist at various points in Quebec, Ontario and Vermont. From September 1894, Mr. Hungerford was chargeman with the Canadian Pacific Railway at Windsor Street in Montreal. From this date his promotions were rapid. In 1897 he was assistant foreman, Canadian Pacific Railway, Farnham, Que.; three years later locomotive foreman, Megantic,

S. J. HUNGERFORD, M.E.I.C.

Que., and the following year general foreman, McAdam Junction, New Brunswick. In the same year he was transferred to Cranbrook, B.C., as locomotive foreman, and from February 1903 to January 1904 he was located at Calgary, as master mechanic, Western Division, Canadian Pacific Railway. In 1904 he took charge of the Winnipeg locomotive shops as superintendent, which position he held until joining the engineering staff of Canadian Northern Railway in March 1910, with which company he was appointed superintendent of rolling stock with headquarters at Winnipeg; two years later moving to Toronto in the same capacity. In November 1917, he was appointed general manager of the eastern lines of the Canadian National Railway and the following year was chosen as vice-president of Canadian National and Canadian Government Railways.

Heads Ass'n of Canadian Advertisers

H. S. Van Scoyoc, M.E.I.C., of Montreal, was elected president of the Association of Canadian Advertisers, at the annual convention held in Toronto, on October thirteenth. Mr. Van Scoyoc, is consulting engineer in charge of the consulting engineer service and promotion department of the Canada Cement Company, Limited, and consulting engineer to the Toronto-Hamilton Highway Commission. Mr. Van Scoyoc graduated in applied science from the University of Pennsylvania in 1907 and for a number of years was assistant engineer of the city of Altoona, Pa. In July 1912 he was appointed inspecting engineer with the Canada Cement Company, Limited, and in this capacity assisted in a wide variety of concrete work throughout Canada, particularly cement-concrete paving. He was appointed chief engineer of the Toronto-Hamilton Highway Commission in November 1914 which position he occupied until February 1918 when he was appointed to his present positions with the Canada

H. S. VAN SCOYOC, M.E.I.C.
President Association of Canadian Advertisers.
President Montreal Publicity Association.
Vice-President Associated Advertising Clubs of the World.

Cement Company and the Toronto-Hamilton Highway Commission.

Invents overhead carrier for Fire Hose.

J. S. Kingston, A.M.E.I.C., of the engineering staff of the Department of Public Works, has invented a simple portable equipment for carrying fire hose above street traffic. He claims that the equipment can be carried on a brigade wagon and put in operation by two firemen in less than five minutes. The equipment consists of a light steel "H" iron column inserted into a cast iron box or socket, that has previously been imbedded into the road between the up and down railway tracks opposite a fire hydrant, with swivel, hinged joints at its base, also a brass or copper bridge pipe insulated on the exterior with rubber as a means for preventing contact with trolley wires through careless erection. This bridge pipe is inserted into the top of the iron column and by a turn of a screw lever is made rigid, from the street level.

The standard is then raised and when in an upright position, a locking device falls into slots that secure same. The upright column is then turned at the swivel joint on its base by levers, so that the hose bridge is in a transverse position to the line of traffic. A brigade wagon is then drawn near the hydrant and a short section of hose is connected from the fire hose bridge to the hydrant on the one end and a length of one or more lines of hose is attached to the opposite end. Mr. Kingston has been granted a Canadian patent for this equipment, and has applied to the United States and British Governments for similar patents.

G. J. Desbarats, C.M.G., M.E.I.C., to succeed to position of Deputy Minister of Defence.

G. J. Desbarats, C.M.G., M.E.I.C., is to succeed to the position of Deputy Minister of Defence. Mr. Desbarats, who has been for some forty years in the Dominion public service, was deputy minister of the Naval Service when the legislation amalgamating the Militia and Naval departments and air board in one department of defence was enacted last session and became operative. After the amalgamation Mr. Desbarats became comptroller in the department. He was named acting deputy minister of defence when Major-General Sir Eugène Fiset was obliged by ill-health to retire from the office of deputy head of the department. Mr. Desbarats is to succeed General Fiset as deputy minister. Mr. Desbarats entered the public service in 1879, when he was appointed to the

G. J DESBARATS, C.M.G., M.E.I.C.

Department of Railways and Canals. He has since served as inspector of Railway construction in British Columbia on the hydrographic survey of the St. Lawrence river, as director of the Government shipyard at Sorel, as deputy minister of Marine and Fisheries for a period, and as deputy minister of the naval service from 1910 to 1922. In the last-mentioned capacity he was called upon to perform important duties during the war. He was appointed a Companion of the Order of St. Michael and St. George in 1914.

McGill Graduate Appointed Deputy Minister

Douglas Lauchlin McLean, B.SC., A.M.E.I.C., who graduated with honours in civil engineering from the Faculty of Applied Science in McGill 1909 has been appointed deputy minister of public works for the province of Manitoba. Mr. McLean was born at Ottawa on August 20th, 1886, and after attendance at the Ottawa public school and Collegiate Institute spent a year on the National Transcontinental, following which he came to McGill where he was popular with his fellow students. Following graduation he became assistant to J. B. McRae, M.E.I.C., hydraulic engineer, and later was assistant chief engineer for the International Commission. He was then appointed chief engineer of the water power surveys of the Winnipeg rivers, Department of the Interior. At the time of the present appointment Mr. McLean was chief engineer of the Manitoba Drainage Commission. Mr. McLean is an enthusiastic McGill graduate and takes an active part in the engineering profession, being an associate member of *The Engineering Institute of Canada* and taking a prominent part in the affairs of the Winnipeg Branch of *The Institute.*

Development in Peat Fuel Handling

E. V. Moore, M.E.I.C., who for many years has been closely associated with research work in connection with the manufacture of peat fuel, is responsible for the design and installation of the government peat plant at Alfred, which was recently inspected by the Hon. Charles Stewart, Minister of the Interior and of Mines, with officials of the Mines Branch. The crucial problem in the manufacture of peat fuel as pointed out by Mr. Stewart, is one of cost, and this is being solved by the substitution of ingenious machinery for the expensive hand labour formerly employed, so that peat fuel is being sold at five dollars a ton, f.o.b. Alfred. Much of this machinery has been specially designed by Mr. Moore, at the Alfred bog, and hand labour is reduced to a minimum. The peat is dug by a large steam digger operating like a dredge. This is mounted on caterpillar wheels and moves along slowly under its own power as it "eats up" the bog. It also beats up the peat in a power hammer-mill similar to that used in paper making and then passes it on to the conveyor and mechanical spreader.

The total area overlain by peat in Canada is estimated at 37,000 square miles, of which about 12,000 acres of an average depth of 6 feet are in Manitoba, Ontario, Quebec and New Brunswick. Some idea of the enormous potential energy in this, provided the experiments at Alfred are successful in evolving a commercial process of manufacture, may be obtained when it is known that the above mentioned 12,000 square miles contains about nine billion tons of peat fuel. The Mines Branch state that seven bogs within shipping distance of Toronto are estimated to be capable of producing 26,000,000 tons of fuel and seven bogs in the vicinity of Montreal and Ottawa could provide 23,000,000 tons.

The present experimental work at Alfred is being carried on under the direction of the Peat Committee consisting of B. F. Haanel, M.E.I.C., Mines Branch, Ottawa; R. A. Ross, M.E.I.C., consulting engineer, Montreal; Arthur A. Cole, mining engineer of the T. & N. O. railway, and R. C. Harris, commissioner of works, Toronto. This committee is appointed by the Dominion and Ontario governments each of whom have granted $35,000 annually for the last three years to carry on the work.

Recent Visitors at Headquarters from out of town

E. P. Muntz, A.M.E.I.C., Toronto; T. A. MacLean, M.E.I.C., Greening, Quebec; Peter Gillespie, M.E.I.C., Toronto; H. C. Nourse, A.M.E.I.C., Sherbrooke, Quebec; J. H. Devery, A.M.E.I.C., Vancouver, British Columbia.

EMPLOYMENT BUREAU

AND MEMBERS' EXCHANGE

To make this department more valuable it is proposed that in future advertisements of situations vacant should state salary, and give details of requirements.

Situation Wanted

Civil Engineer

Civil engineer, M.E.I.C., 18 years experience in Canada in railway engineering. In charge location, construction and maintenance, also experienced in municipal works, etc. Scotchman, 39 years of age, desires position as contractor's superintendent and engineer or with railway in charge of engineering works. References on application. Apply Box No. 117-P.

Experienced Steel Plant Engineers

A number of engineers who have held responsible positions with a steel company in Canada are open for engagement. All are corporate members of *The Institute* and high class men. Address Box 122-P.

Civil Engineer

Graduate of University of Toronto 1921; one and a half years' experience on cost and sales statistics; four years on highway location and land surveys; overseas; desires position on production work or time-study work with pulp and paper company or other large industry in Canada. Apply Box No. 120-P.

Mechanical-Structural Engineer

Young graduate mechanical-structural engineer, age 26, married, good on organization and detail work, wants employment on live mechanical or structural work. Willing to work hard at reasonable wage to start, if good future is offered. Training includes experience and special study on power (steam, hydraulic, and electric), combustion, meter, and experimental engineering. Can report on short notice, detailed information as to education, experience, and references. Apply Box No. 113-P.

Construction Engineer

Graduate of McGill, 1916, with experience as draughtsman, designer, inspector, instrumentman, construction work and assistant engineer. Open for employment immediately. Apply Box No. 121-P.

Civil Engineer

Graduate of McGill, 1915, B.SC., A.M.E.I.C. At present in charge of maintenance of way and building department of a railway company. Would like to better his position. Speaks both French and English. Has had experience as assistant engineer for a municipality on road and sewer construction, on hydrographic survey as instrumentman and also in charge of party. Would consider any line of business with prospects of advancement. Apply Box No. 123-P.

Electrical Engineer

Graduate of McGill University, 1914, A.M.E.I.C., ten years' experience in construction, operation and maintenance. Age 30, married. At present assistant chief engineer for power company in the South, available now. Salary expected $250.00 per month. Apply Box No. 124-P.

Members' Exchange

Instruments for Sale

One Charles Hearn, theodolite, 2½-inch needle; one Andrews theodolite, 4-inch needle; one Troughton level, 13 inches long, also small pocket compass, tape and chain. Apply Box No. 26-A.

ELECTIONS AND TRANSFERS

At the meeting of Council held on October 24th, 1922, the following elections and transfers were effected:—

Members

HAVENS, Verne Leroy, Editor and Director, Ingenieria Internacional, tech. magazine in Spanish on civil, elec'l., mech. and mining engr'g., McGraw-Hill Co., 10th Avenue, New York City.

HOWE, Clarence Decatur, B.Sc. (Mass. Inst. of Technology), partner C. D. Howe and Company, consltg. engrs., Port Arthur, Ont.

Associate Members

BAILY, Paul, C.E., L.Sc., (Univ. of Ghent, Belgium), City Engineer, Verdun, Que.

CAMPION, William, asst. engr., Welland Ship Canal, St. Catharines, Ont.

FALKNER, John William, P.O. Box 118, Summerland, B.C.

GARDNER, Albert Charles, in chg. classification and location parties, hydrometic work, Canada Land and Irrigation Company, Medicine Hat, Alta.

HUNTER, William Howard, B.A.Sc. (Univ. of Toronto), res. engr., building new bridge piers for C.P.R. at Buckingham Junct., Que., for Foundation Company, Limited, Montreal, Que.

IRVINE, Frederick, combustion engr., Cleaton Company (Canada) Limited, Montreal, Que.

JENNINGS, Michael Wallace, B.Sc. (New Brunswick Univ.), asst. engr., C.N.R., Port Arthur, Ont.

PAINE, Arthur James Carman, B.Sc. (Arch.—McGill Univ.), in chg. of erection of addition to Sun Life Assurance Company's head office building, under direction of their architects, Darling & Pearson, Ottawa, Ont.

STALFORD, Victor Kennedy, private practice, consltg. and supervising elec'l. engr., Hamilton, Ont.

STEWART, Andrew Ernest, B.Sc. (C.E.—Univ. of Sask.), of Moose Jaw, Sask.

Juniors

CRABTREE, Henry Swift, dftsman. and designer, Dept. of Public Highways, Toronto, Ont.

WEATHERHEAD, Albert Victor, architect, concrete engr. and contractor, specializing in concrete constrn., Amherst, N.S.

Transferred from the class of Associate Member to that of Member

EASTON, Frank Stewart, B.Sc. (Eng.—Glasgow Univ.), ch. civil engr., re-constrn. track system and new constrn. and mtce. of rlys. and bldgs., etc., Mexico Tramways Company, Mexico Light and Power Company, and subsidiaries, Mexico City, under G. R. G. Conway, M.E.I.C., Managing Director, Mexico.

HEARNE, Alfred Robert James, engr. in chief, Han-Pu District, Chinese Govt., Tientsin Pukow Rly., Nanking, China.

MOORE, John MacKenzie, consulting engr. and architect, London, Ont.

VERNON, Bruce, C.E. (Univ. of Penna.), principal asst. engr., Montreal Tramways Company, Montreal, Que.

Transferred from the class of Junior to that of Associate Member

BEAUDOIN, Horace, chg. of design and supervisn. of constrn. of water wks., sewers, highway bridges, etc., with V. E. A. Bélanger, consltg. engr., Hawkesbury, Ont.

MANSBRIDGE, Alfred, engr. and dftsman., Trussed Concrete Steel Company, Walkerville, Ont.

OSLER, Charles Ernest, inspecting engr., G.T.Rly. System, Montreal, Que.

SNIDER, Arthur Melville, B.A.Sc. (Univ. of Toronto), of Sherbrooke, Que.

Transferred from the class of Student to that of Junior

GAGNON, Alban, C.E. (Ecole Polytechnique, Montreal), highway engr., Leger and Charlton, Limited, Lachine, Que.

WILSON, Hugh Allen, B.Sc. (McGill Univ.), in chg. of tests on mech. apparatus throughout plant, improvements on steam system, Canadian Salt Company, Limited, Windsor, Ont.

BRANCH NEWS

Toronto Branch

O. M. Falls, A.M.E.I.C., Secretary-Treasurer.

Opening Meeting

The opening meeting for the season of the Toronto Branch was held on October 12th, and a large number of the members were present to greet their Chairman elect, Wm. Storrie, M.E.I.C.

After thanking the Branch for his election as Chairman, Mr. Storrie outlined in a general way the activities planned for the coming season and intimated that after the New Year sectional meetings would be introduced; four of the ten meetings of the winter session being reserved for a municipal section. He referred briefly to the passage of the Professional Engineers Act at the last Session of the Legislature and strongly urged upon all engineers the maintenance of a high standard of professional ethics, the elimination of wire pulling and dishonorable methods in securing engineering appointments. In the latter part of his address Mr. Storrie dealt with the effect of municipal water purification and sewage treatment upon the health of the community. Some very interesting figures were quoted to show the decrease in typhoid mortality due to increase in municipal expenditure for water purification in Toronto and throughout the Province.

At the request of the chairman Prof. H. E. T. Haultain, M.E.I.C., R. O. Wynne-Roberts, M.E.I.C., and R. B. Wolsley, Secretary and Registrar, briefly addressed the meeting in the interests of the Provisional Council under the Professional Engineer's Act. They urged all engineers to register under the Act and by thus showing their approval thereby aid in securing necessary amendments to the Act. It was stated that there were approximately three thousand engineers in the Province eligible to register and that application forms and copies of the by-laws of the Association would be sent out by the secretary within the next two weeks.

The Chairman introduced to the meeting Prof. Ellis, A.M.E.I.C., of the Department of Metallurgy, University of Toronto, and expressed the desire that the Branch might be favoured with a paper by the Professor during the coming season.

After Mr. Storrie had called upon the various members of the executive present for a few remarks, sandwiches and coffee were served.

The Manufacture of Tin Plates

At the meeting of October 19th, S. R. Cound, Esq., General Manager of the Canadian Baldwins Steel Corporation Ltd., gave a very interesting informal talk on the manufacture of tin plates and plant operation. After tracing the general development of the tin plate industry from its inception in 1230, its introduction into Wales in 1660 up to the present time Mr. Cound referred briefly to foundation and other problems met with during the construction of their Toronto plant at Ashbridges Bay. Not the least interesting of these was the foundation to carry the drive wheel for the presses which, with its bearings, weighed approximately two hundred tons.

Mr. Cound described in details the various stages in the manufacture of black plate and white plate, including the heating, rolling, pickling, annealing, cold rolling and platting. The supremacy of Wales in the tin plate industry Mr. Cound attributed to the skill, enthusiasm and pride in their work exhibited by the various tradesmen employed. In no other part of the world were to be found tradesmen so apt in this industry as in Wales where generation after generation have wrought to perfect the manufacture of tin plate. Lantern slides very clearly illustrated the equipment and operation of the Toronto plant.

In the discussion which followed Professor Ellis, J. M. Oxley, M.E.I.C., W. J. Smithers, A.M.E.I.C., Prof. P. Gillespie, M.E.I.C., R. O. Wynne-Roberts, M.E.I.C., G. W. Winckler, M.E.I.C., and others spoke.

G. T. Clark, M.E.I.C., presided at the meeting owing to the fact that the Chairman, Mr. Storrie, was indisposed.

Chairman's Inaugural Address

Gentlemen:—

I need scarcely say that I appreciate the honour you have done me in electing me your chairman for the present year. With the hearty co-operation of all the members of the Branch your Executive hopes to make this winter's programme the best of a series of successful years. I hope the members will regularly attend the meetings and thus encourage the Executive to furnish you with the best possible speakers on subjects of practical value to the engineering profession.

The inaugural addresses delivered by my two immediate predecessors contain enough food for thought and practical suggestions regarding the engineer and his varied activities as to keep *The Engineering Institute of Canada* busy for many years to come in an effort to fulfill all that has been put forth. I sincerely hope the view points advocated in these addresses will be kept in mind and every effort made to secure the establishment of some of the many ideals indicated. I wish to refer first of all to certain matters that have a bearing on the winter's programme and *Institute* affairs in general, and then to deal shortly with that branch of engineering with which I have the privilege to be connected.

The Branch secretary, F. B. Goedike, A.M.E.I.C., has resigned his position on the Executive owing to his having accepted an appointment in Hamilton. The thanks of the Executive have been conveyed to Mr. Goedike for his eighteen months' efficient service as secretary. Acting under the Branch by-laws, the Executive has appointed O. M Falls, A.M.E.I.C., as secretary, and he has kindly consented to act.

The Executive has decided to hold ten meetings between now and Christmas and ten from the middle of January to the annual meeting on March 15th. Arrangements have been made to bring before the Branch speakers of outstanding ability who will deal particularly with the business side of engineering. Such subjects as municipal finance, the local improvement act, public speaking and the giving of expert evidence will be dealt with by men well qualified to speak on such matters. Evenings have been set apart for discussions on town planning, fees and policy, while the remaining evenings will be taken up by technical engineering subjects. An effort will be made to develop the social side as well as introducing a debate on some live topic.

In common with others, I believe the Toronto Branch is large enough in numbers to try out sectional meetings. With this object in view I intend asking your Executive to make a start with a "Municipal Section", giving this section full charge of four out of the ten meetings to be held after Christmas. I should like to see this given a fair trial and should your Executive decide to proceed with the formation of such a section I hope those members of the Branch who are interested will give it their hearty support.

As you are all aware, the Ontario Legislature finally passed what is known as "The Professional Engineers' Act, 1922". The Act as passed does not go as far as we should like and to many it is a disappointment that the Legislature modified the bill as submitted. However, it is a step in the right direction and, in the opinion of those best able to judge it, it is felt that the terms of the Act should be put

into force. Willis Chipman, M.E.I.C., in the June number of *The Engineering Journal* has very ably dealt with the situation as it existed after the passing of the Bill.

Since then the Provisional Council appointed under the Act has been busy getting things into shape and now await the approval of the Lieutenant-Governor in Council to the by-laws drawn up before registration can commence. R. B. Wolseley, the genial secretary of the Engineers' Club, has been appointed registrar and secretary-treasurer of the Association of Professional Engineers and almost any day now full particulars will be available for all to register under the Act. The headquarters of the association have been arranged in the Engineers' Club building. The registration fee is ten dollars and the annual fee has been fixed at five dollars. It is well to remember that the Association of Professional Engineers has a clearly defined objective, the registration and safeguarding of the interests of the engineer, and will not conflict in any way with *The Engineering Institute of Canada*. I am sure the Provisional Council appointed under the Act will have the hearty co-operation of the members of the Toronto Branch and that everything possible will be done to make the working out of the Act a success.

A decided step forward has been taken by the Council of *The Institute* in approving of the Committee on Policy's recommendation whereby each member of Council will have his expenses paid once a year to the Council meetings. In the past, non-resident councillors have rarely been able to attend the Council meetings in Montreal, as is clearly shown by the statement of attendances contained in the Committee on Policy's report. With the Toronto Branch having three councillors it will thus be possible by an arrangement amongst themselves whereby they will be present at different meetings and thus enable the Branch to keep in closer touch, through their representatives, with the Council at headquarters.

There is a growing feeling among engineers that a Code of Ethics should be drawn up. I very heartily agree with this and I am delighted to note that the Council of *The Institute* have appointed a committee to report on the proposed code recently published by a committe consisting of representatives from the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Society of Heating and Ventilating Engineers. This Joint Committee's letter of explanation and the proposed code are given on page 511 of the October *Journal* and should be closely studied by the members of this Branch. I commend this report as being brief and to the point. The ten clauses of the Proposed Code of Ethics will bear repetition here.

> "That the dignity of their chosen profession may be maintained, it is the duty of all engineers to conduct themselves according to the principles of the following Code of Ethics:
>
> 1. The engineer will carry on his professional work in a spirit of fairness to employees and contractors, fidelity to clients and employers, loyalty to his country and devotion to high ideals of courtesy and personal honour.
> 2. He will refrain from associating himself with or allowing the use of his name by an enterprise of questionable character.
> 3. He will advertise only in a dignified manner being careful to avoid misleading statements.
> 4. He will regard as confidential any information obtained by him as to the business affairs and technical methods or processes of a client or employer.
> 5. He will inform a client or employer of any business connections, interests or affiliations which might influence his judgment or impair the disinterested quality of his services.
> 6. He will refrain from using any improper or questionable methods of soliciting professional work and will decline to pay or to accept commissions for securing such work.
> 7. He will accept compensation, financial or otherwise, for a particular service, from one source only, except with the full knowledge and consent of all interested parties.
> 8. He will not use unfair means to win professional advancement or to injure the chances of another engineer to secure and hold employment.
> 9. He will co-operate in upbuilding the Engineering Profession by exchanging general information and experience with his fellow engineers and students of engineering and also by contributing to work of engineering societies, schools of applied science and the technical press.
> 10. He will interest himself in the public welfare in behalf of which he will be ready to apply his special knowledge, skill and training for the use and benefit of mankind."

Now, gentlemen, I must of necessity strike an unhappy note. The fixing of fees, the creation of a code of ethics, the establishment of engineering policies and the securing of legislation will be of no avail if we fail in their practical application. We have a duty to perform to the public as well as the public having a duty to perform towards us. We must honestly and fearlessly show up and endeavour to stamp out everything in the profession that savors of wrong doing. Ability and reputation should be the means of securing our individual progress rather than the amount of wire-pulling and so-called influence that is so often brought to bear on the securing of appointments. I recently heard of a reeve stating at a Municipal Council meeting that he was disgusted with the tactics adopted to secure an engineering appointment by one engineering firm who had "parked on his doorstep" ever since the vacancy occurred. In another case to which my attention was drawn, the influence of contractors who had received contracts from a firm of engineers was widely used to secure a certain appointment. Under such circumstances, how could this firm be fair and just in their dealings with these contractors?

This form of securing the influence of contractors who have received contracts from engineers is a serious affair and one that should not be employed under any condition. I know of a case where one alderman absolutely committed himself to a contractor to vote for a certain engineering firm before he even knew who were being considered for the appointment, or before the committee investigating the status of the various engineers had brought in a recommendation. Needless to say, this contractor had in the past received several contracts from the engineering firm for whom he was working. In yet another case the manager of a contracting company approached one of his shareholders, asking him to do his utmost to have the rival firm withdraw its application in order to ensure the continuance of certain contracts that it had been accustomed to receive from the engineering firm they were anxious should secure the appointment. Apart from other considerations this means of securing certain work is an absolutely unfair situation in which to place any contractor and strenuous means should be taken to overcome such unprofessional conduct.

During the present year my firm has found it necessary on two occasions to issue flat denials regarding statements made by a firm of engineers about work carried out by ourselves. Statements were made by the opposing firm as to defective work done by us which they positively knew to be absolutely untrue. In each case ample proof was forthcoming and the statements were easily refuted. One can readily understand that if this state of affairs is allowed to continue considerable damage to the profession and loss of prestige will result. The sooner the public realize that when tactics like those I have just mentioned have to be adopted in order to secure work there must be something seriously wrong with the engineering ability of the firm that finds it necessary to adopt them, the better it will be for the engineers as a whole. If we wish to be seriously considered by the public as a profession, let us see to it that we adopt professional conduct in our business affairs. It is only my great respect for our profession and my jealous regard for what I consider the ideals for which it stands that induce me to make these somewhat personal remarks. As your chairman I feel I should not be doing my duty if I failed to bring this matter to your attention. The exposing of such tactics will, I believe, do more than anything else to cleanse the profession from such practices. Fortunately for the profession we have, as a whole, a fine body of men but that is all the greater reason for jealously guarding our interests and exposing the few who would seek to lower our ideals. Let us keep in mind the legend that appears on the cover of the *Journal:* **"To facilitate the acquirement and interchange of professional knowledge among its members, to encourage original research, to develop and maintain high standards in the engineering profession and to enhance the usefulness of the profession to the public."**

Gentlemen, we must purge the profession of that kind of work and set our own houses in order and above reproach before we can expect that recognition from the public to which we are justly entitled and before legislation, minimum fees or ethics can be of any avail. Let us jealously guard our ideals and show an ever increasing factor of moral safety and courage in our dealings with the public and our fellow engineers.

There is a growing tendency throughout Canada to recognize the ability of the Canadian engineer. Occasionally one finds a natural inclination existing to bring engineers from the United States when some big problem arises but we must impress our authorities with the necessity of seriously investigating the capabilities of the home product before going over the line. There is scarcely a field of engineering, that cannot be successfully undertaken by the Canadian engineer.

and in almost every case the home engineer starts out with a distinct advantage due to his knowledge of the climatic conditions. Take the question of sewage disposal, for instance, — the climatic conditions form a big factor and much knowledge is to be gained from local conditions. The Ontario Provincial Board of Health and the city of Toronto have carried out splendid research work in this field and the Canadian engineers who have closely followed this work are as capable as any of dealing with the disposal of sewage. Let me just point out that of all the systems of sewage disposal that have been invented, and that can be said to have operated with success, all but one have been invented within the Empire and even that one, (the Imhoff system), is an advance on the old Travis tank, a British product. Let us make certain that this increasing tendency to employ Canadian engineers is encouraged in every conceivable way, but chiefly by ensuring that the solution of such problems is placed in the hands of men capable and qualified to deal with them.

Let me now make a reference to "The Engineer and Public Health." Practically every piece of engineering has an effect on the health of the people. This effect is of a varied nature reaching its maximum in that branch of engineering dealing with water supply and sewage disposal and it is these two phases to which I propose to refer very shortly to-night. All New York State Board of Health bulletins have this statement prominently displayed: "Public health is purchasable; within natural limitations any community can determine its own death rate." This statement sums up to a nicety the situation on all public health matters. The life and death of the citizens is an economic problem depending almost entirely on two essentials, — education and expenditure of money. It has been well said that education respecting health matters is the light that will eventually lead us out of the unsanitary wilderness.

We hear a great deal these days about economy. It is the cry of the present day and there can be no doubt but that the financial situation of the country demands economy. War, industrial strife, and strikes are waste and everything possible should be done to stop this waste. However, this cry of economy opens up a possibility of great danger by delaying restoration, reconstruction and progress. Economy must be prevented from becoming merely a popular cry. It must be borne in mind that the mere stoppage of expenditure of money may not be economy but may result in real waste. It is not economy to refrain from the expenditure of money that will ensure to all the people an abundant supply of pure wholesome water, protected not only by the purification of the water but by the efficient treatment of the sewage. There is no expenditure of public funds that brings such excellent results as that spent on improving the health of the citizens. It can be most clearly shown, by considering some of the leading cities of Ontario, that there is a very close relation between the death rate and the amount of money spent by the public health department.

The case of the city of Toronto where the water supply is both filtered and chlorinated is particularly interesting as will be seen from the following year to year table respecting typhoid fever:

Year	Amount spent per head of population	Typhoid fever death rate per 100,000	Year	Amount spent per head of population	Typhoid fever death rate per 100,000
1905	\$0.24	17.2	1914	\$0.59	8.1
1906	0.24½	27.6	1915 (c)	0.64	1.9
1907	0.25	21 3	1916	0.67	6.9
1908	0.27	20.9	1917 (d)	0.83	3.8
1909	0.27¼	24.7	1918	0.90	3.1
1910 (a)	0.27¼	44.2	1919	1.25	2.6
1911	0.41	21.6	1920	1.72	2 3
1912 (b)	0 45	13.2	1921	1.58	3.1
1913	0.53	11.4			

(a) Chlorination starts.
(b) Slow sand filters start.
(c) Pasteurization of milk starts.
(d) Drifting sand filters start.

The cleaning up of the water supplies of the province of Ontario has been gradual and its effect is plainly shown in the following table relating to the typhoid death rate per hundred thousand of population in the different types of community in the province:

Year	Counties	Cities (excluding Toronto)	Toronto	Towns	Average for Province
1921	...	...	3.1	....	...
1920	6.2	5.5	2.3	25.0	7.0
1919	4.6	4.3	2.6	19.5	5.2
1918	5.1	9.6	3.1	17.2	7.5
1917	6.6	7.5	3.8	31.4	8.4
1916	8.1	12.1	6.9	52.2	12.5
1915	9.4	9.4	1.9	38.0	10.7
1914	10.0	12.4	8.1	47.4	13.5
1913	13.3	17.3	11.4	46.0	17.7
1912	10.9	27.7	13.2	47.0	18.7
1911	16.1	35.8	21.6	62.3	25.3
1910	22.0	51.5	44.2	56.4	31.5
1909	25.1	34.3	24.7	67.7	29.9
1908	20.5	37.8	20 9	107.1	29.7

It is interesting to note that in every case where cities have a much lower typhoid rate than towns, it is due unquestionably to the more complete control of the water and milk supplies and to a greater degree of completeness of the sewerage and sewage disposal systems. The table shows that so far as the towns are concerned they are considerably behind the cities in the typhoid death rate showing the necessity in the towns of having improved water and milk supplies.

The city of Toronto previous to 1910 took its water supply from lake Ontario without treatment of any kind. Following a mild typhoid epidemic in 1910, the raw water was chlorinated. In 1912 a slow sand water purification plant was put into use so that for that year the raw water was partly filtered and chlorinated. In 1917 the drifting sand water purification plant was put into operation while in 1915 the city passed a by-law enforcing the pasteurization of the milk supply. Toronto's typhoid mortality rate per hundred thousand of population during these years was as follows:

1910 — 44.2	1913 — 11.4	1916 — 6.9	1919 — 2.6
1911 — 21.6	1914 — 8.1	1917 — 3.8	1920 — 2.3
1912 — 13.2	1915 — 1.9	1918 — 3.1	1921 — 3.1

This has been accomplished notwithstanding the fact that during the last ten years the pollution of the raw water had increased enormously. Thus in 1910 before the water was treated in any way the typhoid mortality rate was 44.2 per hundred thousand of population while in 1921 the rate had decreased to 3.1 per hundred thousand, a very striking result due to a large extent to the efficiency of filtration and sterilization of the water supply. To put it in another way, — if the same typhoid death rate had taken place last year as occurred in 1910 there would have been approximately 220 deaths whereas there were only 16. The following table shows the death rate from typhoid fever compared with the expenditure of the public health departments:

Place	Year	Typhoid death rate per 100,000	Amount spent per head on public health
Province of Ontario....	1919	5.2	\$0.20
City of Toronto.......	1919	2.6	1.25
Cities other than Toronto...........	1919	5.6	0.70
Towns...............	1919	19.5	0.70

While the most effective work of the engineer in relation to public health has undoubtedly been connected with water supply and sewage disposal, other fields have contributed towards the betterment of the health of the community. I need only mention the great work done by irrigation and drainage in relation to malarial fever, particularly in reference to the work done on the Panama canal. There are other forms of engineering work that are rapidly coming to the front, particularly in reference to sanitation and industry. It has been clearly shown the tremendous effect of dust removal in the reduction of tuberculosis in certain classes of industry. The controlling of the air supply in industry by the conditioning of the moisture and

temperature have had wonderful effects in relation to fatigue and output of the workers. Better lighting systems have been introduced thus preventing many accidents due to bad lighting and fatigue. Wonderful progress has been made in general ventilation and with all these problems the engineer has been very closely connected.

I have endeavoured to show what this branch of engineering has been able to do for the health of the citizens particularly in this neighbourhood. It is unnecessary to dwell at any length on the part played by the engineer in securing this increasingly satisfactory state of affairs as to one and all it is self-evident that to a very large extent the engineering profession is responsible for arriving at the methods, the design, the construction and operation of the systems that have attained the desired results. The remuneration of an engineer for the carrying out of this work is of two kinds, — the actual monetary consideration received and the satisfaction which must accrue to him from the successful carrying out of any form of engineering work affecting the health of the citizens. The responsibility placed on the engineer is a heavy one and he must make absolutely sure of his ground before proceeding with the work. Most engineering is visible and any mistakes that may be made are open to the public view. In this respect we are unlike the medical profession where most of their mistakes are under ground.

It is only necessary to make a close study of the tables and statistics available to realize what tremendous advances have been made in sanitary engineering. In the city of Toronto we know beyond all doubt what improved water and milk supplies have done towards reducing typhoid fever. That can be definitely ascertained from the figures available but that does not end the effectiveness arising out of these improved conditions. There is no doubt whatever but that the general health of the whole community is benefited but the precise amount of benefit derived cannot be ascertained from the statistics.

While such great improvements have taken place particularly in the sciences of water supply and sewage disposal I firmly believe that we have yet a great deal to learn particularly in reference to sewage disposal. A study of the history of water purification indicates improved conditions being arrived at step by step so that now a filthy, dangerous water may be made clear, sparkling and sterile in fifteen minutes; and while greater advances have been made in the purification of water than in the satisfactory disposal of sewage there still remains a wide field for research work in connection without water supplies.

A much more difficult problem is the satisfactory disposal of sewage and particularly of the sewage sludge and I believe we are on the verge of great developments along these lines. The satisfactory disposal of sewage in most communities is essential if for no other reason than the protection of other municipal water supplies. The unsatisfactory nature of many sewage disposal plants erected in the past has frequently developed into a nuisance as well as a source of pollution of water supplies. While large expenditures in the past have taken place in protecting our water supplies, many municipalities in this province are faced with heavy expenditures on sewage disposal. During the last ten years a great deal of research and experimental work in sewage disposal has been carried on. There still remains the problem of the satisfactory disposal of sludge to be solved but there is every indication that this is in a fair way towards solution. While the present generation is busily engaged cleaning up the water supplies and sewage disposal I believe the chief sanitary problem for the coming generation to solve will be connected with the purification of the air. With a tremendous hydro-electric development in this part of the world this is unlikely to be such a burning question, but where many municipalities are dependent largely on coal as their source of power then this matter becomes urgent and every effort towards its solution will very materially react on the health of the community. The increased use of electric power will go a long way towards improving the purity of the atmosphere.

Gentlemen, there is probably no country in this world to-day with the outlook for prosperity that Canada has. We have simply nibbled at the fringe of her great natural resources. There remains undiscovered untold wealth throughout the length and breadth of this Dominion. Ours is indeed a goodly heritage and our lot has been cast in pleasant places.

To the engineering profession will be entrusted the development of these vast natural resources for the benefit of our fellow citizens. Let us fully realize our opportunities and responsibilities and prove worthy of our noble calling.

Saskatchewan Branch

D. A. R. McCannel, A.M.E.I.C., Secretary-Treasurer.

On October 4th, a special meeting of the Branch was held in the City Hall Council Chamber at which Col. H. C. Boyden gave a paper, (illustrated), on "Highway Investigations and Specifications". Though it was a rainy night there was a large attendance including several visitors.

On October 9th, a meeting of the Saskatoon members and engineering students was held at the University of Saskatchewan in Saskatoon, at which R. N. Blackburn, M.E.I.C., Regina, read a paper on "Waters of Saskatchewan for Boiler Purposes".

On October 12th, the first regular Fall meeting of the Branch was held at the Kitchener hotel preceded by a dinner. Following the dinner it was proposed that each member present tell a humorous story. This brought a wonderful collection of yarns most of which were so old that some of them almost got by for new ones — which was "going some". The business of the meeting was then proceeded with. There was a progress report from the Legislation Committee, with a promise of a full report at an early date. The action of Council in regard to payment of the expenses of Councillors to one Montreal meeting a year was received with approval. M. B. Weeks, M.E.I.C., reported on the Western Canada Irrigation Association convention held at Maple Creek, Saskatchewan and Brooks, Alberta. He gave some interesting information as to what crops could and could not be grown successfully on irrigated land. The convention passed a resolution asking the Alberta and Saskatchewan universities to provide courses in irrigation engineering. Mr. Weeks' report was followed by an address by Lieut. Col. A. J. McPherson, A.M.E.I.C., entitled "Some Notes on Irrigation". He gave statistics showing the effect of irrigation on various crops and outlined the various methods of putting the water on the land. Lieut. Col. Garner, M.E.I.C., in discussing the paper gave great praise to the C.P.R., for developing irrigation schemes in Alberta and British Columbia. R. N. Blackburn, M.E.I.C., who presided at the meeting in the absence of the chairman, gave some information on the results of experiments in intensive farming in England. Several other members took part in the discussion.

Ottawa Branch

F. C. C. Lynch, Associate E.I.C., Secretary-Treasurer.

J. S. Kingston, A.M.E.I.C., of the Department of Public Works addressed a general meeting of the Central Ward Municipal Association on the evening of October 3rd, his subject being the fuel situation. The address was decidedly constructive and contained suggestions which impressed the gathering as being quite feasible. Following a general discussion strong recommendations were made in favour of central heating plants and the use of coke ovens.

The city of Ottawa building by-law committee resumed its activities recently. A portion of the proposed revised by-laws will soon be ready to be submitted to the

city council. Members of the committee present at the meeting were:—Ald. T. H. Brewer, chairman; Controller John Cameron; J. Albert Ewart, A.M.E.I.C.; George Crain; H. Newlands; R. Henham, A.M.E.I.C.; and A. F. Macallum, M.E.I.C., commissioner of works.

The Mines Department is issuing a publication entitled "Structural Materials along the St. Lawrence River between Prescott and Lachine, Quebec", by L. H. Cole, B.Sc., M.E.I.C., and Jos. Keele, B.Sc. Copies of this publication are obtainable upon application to the Director, Mines Branch, Department of Mines, Ottawa.

Prof. Cooke of Princeton University will address the Ottawa Branch at a popular public lecture to be held about the end of November or early in December. The subject of his address will be "Recent Development in Aerial Plane Surveying".

Hon. J. E. O. Preuss, governor of the state of Minnesota will address the Ottawa Branch at a luncheon to be held on November 15th, the subject being "The Great Lakes — St. Lawrence Scheme".

Arrangements are being made for a meeting at an early date for the purpose of discussing "Canada's Fuel Problem".

The Ottawa Branch is arranging for an evening meeting to be devoted to a discussion on the various branches of surveying.

J. Grove Smith, B.A., B.Sc., A.R.C.S., F.R.S.A., Dominion fire commissioner, was the guest of honour at a luncheon held on October 12th, at the Chateau Laurier by the Ottawa Branch of *The Engineering Institute of Canada.* K. M. Cameron, M.E.I.C., presided, and with him at the head table were Fire Chief Robt. Burnett; Capt. R. J. Durley, M.E.I.C., secretary, Canadian Engineering Standards Association; A. F. Macallum, M.E.I.C., city commissioner of works; R. F. Uniacke, M.E.I.C., chief engineer, Penitentiaries Branch, Department of Justice; G. A. Mountain, M.E.I.C., chief engineer, Board of Railway Commissioners; H. P. Hill, M.L.A.; J. B. Hunter, Deputy Minister, Department of Public Works; A. H. Laurent, M.E.I.C., chief engineer, Department of Public Works; J. McLeish, Director of Mines Branch; Noel J. Ogilvie, M.E.I.C., superintendent of Geodetic Survey of Canada; A. A. Dion, M.E.I.C., general manager, Ottawa Electric and Gas Company. About ninety members of the Branch sat down to lunch and afterwards listened to a very eloquent address delivered by Mr. Smith.

Before introducing the guest of honour, Mr. Cameron referred to the splendid work done by Mr. H. P. Hill in supporting the efforts of *The Institute* in their endeavour to introduce legislation to improve the status of the engineering profession.

The Automatic Control of Fire

The subject chosen by the Dominion fire commissioner was "The Automatic Control of Fire". Handled by an ordinary speaker the subject would have proved interesting; but delivered by a scholar of Mr. Smith's ability and with his command of the English language, it became engrossing and at times thrilling. His natural gift as a speaker, combined with his very intimate knowledge of the subject, served to bring into relief a fact that is too often ignored, namely, that in the Civil Service of Canada, which so often comes under slighting criticism, there are some officials who for zeal and downright efficiency would be shining lights in any country in the world. He eulogized the work of *The Engineering Institute* and similar associations. One of their chief claims to credit was the fact that they drew professional men out of their shells and brought them face to face with the fact that there are other men with similar thoughts and ambitions, influenced by the same amount of technical knowledge as their own, with whom they come into immediate contact in their daily routine. In referring to the recent disastrous fire in Northern Ontario, he could not help wondering whether Providence had anything to do with the fact that it took place during fire-prevention week.

"We are the most prodigal and wasteful nation on earth," he said. "From childhood we learn to boast of our forest wealth, of our mines and of our vast natural resources. This tends to make us careless in our methods of taping the source of wealth and results too often in uneconomic development. We have not done what we ought to have done in the way of maintaining those wonderful resources handed down to us as an heritage. Nature may replace the wooded slopes denuded by fire, but it cannot rebuild burned cities nor restore lives sacrificed. Moreover, in rebuilding these cities and in repairing the ravages of the demon fire, energy is wasted that could better be employed in constructive rather than reconstructive labour. The fire losses annually in the Dominion reach an appalling figure. In 1921, apart from forest fires, a direct loss of $45,500,000 occurred in property alone. Indirect losses called for the payment by insurance companies of $65,000,000. The department of waterworks expended $24,000,000 in dealing with fire. A total expenditure was incurred of $130,000,000. The destruction of property thus caused an expense of $5.25 per capita, a sum which is at least ten times greater than in any other country except the United States. As a result of this, insurance rates are 5 or 10 times as great as in other countries," Mr. Smith said.

More serious still is the loss of life, which in Canada yearly amounts to between 300 and 450 lives. Sixty per cent of these deaths occur in homes, through gross negligence, but many in institutions and public buildings. The lecturer stated that one schoolhouse is burned every week of the year and one institution, such as a hospital or infirmary, every two weeks. The destruction of North Cobalt and Haileybury and other towns in the recent fire, was due to the fact that the structures were inflammable. For years the department had petitioned the provincial government that towns should be built and planned in order to minimize the danger from fire. A central area should be defined inside which the buildings should be of concrete and steel; that this area should be increased as the city grew and that water mains of adequate size should be laid. Frequently in large cities 4-inch and 6-inch mains would be found which are not capable of feeding even one fair sized fire engine.

The speaker was sorry to say that in other countries, more effective steps were taken to keep down loss of property and life from fire. Laws were rigidly enacted. The fault did not lie in there being no laws, but in the slip shod way in which the existing laws were, or rather were not, enforced. An amusing contrast in this respect

was cited by the lecturer, in the case of London, Ontario. The building by-law of that city occupied a volume of 350 pages, mostly containing technical directions, whereas the city of Birmingham, England, found 15 pages sufficient, and London, England, devoted but a few clauses thereto. In Canada there is great difficulty in enforcing laws that have not public opinion strongly behind them. On the statutes there were hundreds of regulations regarding fire that were never enforced. Consequently the work of the department had to be conducted along educational lines. The object was to demonstrate clearly the efficiency as well as the real need of the precautions they suggested, the means to be adopted of safeguarding life and property and the laws necessary to compel the people to use them. Then the public will say, "We want this law and these regulations," and immediately ensues control. It is, of course, the duty of all citizens to take every precaution against fires and like disasters, but unfortunately duty is not popular with many mere mortals.

Mr. Smith concluded his most interesting address by an eloquent interpretation of every engineer's duty and every citizen's duty to himself, to his city, to his province and to his country. From the point of view of the saving of dollars and cents, from the more serious standpoint of the duty of saving precious lives, adequate protection must be ensured against fire. The most efficient method of securing this end was the development of the community conscience, the city conscience, the determination to think not for oneself, but also for one's fellowmen. "This accomplished, the ideal existence will ensue, when all men's good shall be the moving impulse of each one of us," he concluded amid applause.

Mr. Cameron thanked Mr. Smith on behalf of the members of *The Engineering Institute* for his very interesting and enlightening address.

Following the lecture a series of slides of the cold storage building at Montreal harbour were shown on the screen as illustrating a good fire-proof building. The precautions taken in rendering this building safe from fire were so good that the insurance rate thereon was the lowest in Canada — 2¼ cents per $100. As the value insured is $6,000,000 it can readily be seen what a tremendous saving a low rate achieves.

After these slides, a moving picture was shown which illustrated very lucidly the need in factories for perfect fire quenching devices and the efficiency of the sprinkler system in extinguishing fires before any damage was done. Figures quoted on the screen showed plainly the tremendous outlay yearly on fire engines and devices for pumping water onto and into buildings, and the ineffectiveness of all these measures. In buildings where the sprinkler system has been installed, out of 27,000 fires in the last 13 years, 93 per cent were extinguished with the breaking of one head, and the percentage of efficiency was approximately 98. Moreover, the cost of installation and of maintenance was small — infinitesimal when compared to the property and life saved. The sprinkler heads are broken within a few seconds of the outbreak of fire and an immediate alarm is automatically sounded. In the old method of fighting fire, several minutes elapsed between the start of the fire and action. With this invention action is almost simultaneous with the outbreak of fire. These few minutes mean the saving of thousands of dollars and many lives.

London Branch

F. Jas. Bridges, A.M.E.I.C., Secretary.

R. I. Olmsted, A.M.E.I.C., Branch News Editor.

The first fall meeting of the London Branch was held Saturday, October 7th. The meeting was in the form of an inspection tour in the afternoon, five points of engineering interest in the city being visited, followed by a dinner and a business meeting. In spite of a steady down pour of rain, there was a good attendance to reward the efforts of H. A. Brazier, M.E.I.C., city engineer, and E. V. Buchanan, M.E.I.C., general manager of the Public Utilities Commission of London, who conducted the party, and at each place described the points of interest, and answered questions. The members and visitors were transported in automobiles of different members of the Branch. The members present were: Messrs. Brazier, Buchanan, Angus, Morgan, Bridges, Forbes-Mitchell, Laniel, Miller, Olmsted, Rostron, Talbot, Veitch, Fuller, Madgett, Eckert. The non-members present were: A. O. Hunt and S. W. Peart of the Public Utilities Commission, J. Wallace, engineer for Watt and Blackwell, architects, J. A. Sinclair, W. E. Stephens and H. S. Philips of the city engineer's office, Hamilton.

The party left the city engineer's office at 2.30 p.m., and went first to the city paving plant. This was erected in the spring of 1921. F. D. Cummer and Sons Company constructing the drying and mixing units, Norman McLeod Ltd., the erection of the buildings, the remainder of the work being done by day labour. The total cost of this work was $50,000. The special feature of this plant is the semi-underground asphaltic cement storage tank constructed of super cement, with a capacity of 120 tons and equipped with continuous steam coils for heating. The actual average output of this plant for 1921 was 1,980 square yards in nine hours, over a total of 128,000 square yards.

The East End disposal works was next visited. These works, which were designed for a population of 60,000, were erected in 1914, and consist of three sedimentation tanks, two dosing chambers, two filter beds, two humus tanks and sludge drying beds. The daily flow at present varies from 360,000 to 800,000 gallons per twenty-four hours. The sedimentation tanks are of the two story non-reversible type with a velocity of flow approximately one-quarter of a foot per minute, giving an average of two hours detention. The sludge capacity of each tank is eighty cubic yards. Each filter is 160 feet long by 40 feet wide with sixty-four fixed sprays in each. The average discharge of each nozzle is about nine gallons per minute. The entire filter beds and dosing chamber are housed in a reinforced concrete building. The humus tanks are 21½ feet internal diameter, with a total depth of 25 feet, having a capacity of twenty-five thousand gallons sewage and thirty-six cubic yards sludge. The sludge beds are each 50 feet by 65 feet.

The party was then driven over to the garbage incinerator plant. This incinerator was erected in 1912

by Messrs. Laurie and Lamb, at a cost of $39,750. It is of the Heenan and Froude high temperature type having three cells each about thirty square feet effective grate area. The capacity of this plant is fifty tons of garbage and refuse per twenty-four hours and does not require any fuel with the exception of starting. The gases from the furnace pass through a combustion chamber where a temperature of 1,500 to 2,000 deg. F. is maintained. The steam generated together with that from two 150-h.p., boilers, is used for heating Victoria hospital which adjoins the incinerator.

The combined electrical distributing station and artesian wells pumping plant at the corner of Ridout and Horton streets was next visited. The party inspected the transformers and switchboard for the lighting and power systems, the 600-volt rotary converters for the local street railway system, and the 1,500-volt rotary converters for the London and Port Stanley Railway. Housed in the same building are the electrically driven air compressors for raising part of the city's water supply from wells, and also the electrically driven turbine pumps which discharge the water that is raised from the wells into the city mains. Adjoining the station is a million gallon covered concrete reservoir, and also the iron removal plant which consists of an areator constructed on the top of a settling basin which feeds the areated water by gravity through six pressure filters into the million gallon reservoir.

The last place inspected was the Douglas Avenue pumping station. This was designed to take care of 8,000,000 gallons per twenty-four hours being the anticipated maximum flow from London West and the low lying districts along the banks of the river. The equipment consists of four 8-inch horizontal centrifugal Aurora pumps each directly connected to a 35-h.p., Crocker Wheeler motor, each pump having a capacity of 1,350 Imperial gallons per minute against a maximum head of 50 feet. The motors are operated automatically by floats and are protected from sudden stoppages. A simplex Venturi meter is installed on the 20-inch discharge main, which crosses under the river to the main outfall syphon chamber. The general contractors for this station were John Hayman and Sons, Limited, their contract price being $32,460., exclusive of pumps and electrical equipment.

By this time all members of the party had developed hearty appetites so they drove to the DeLuxe café. It was 7.45 p.m., before the appetites of all were satisfied, the party then going to the board room of the Public Utilities Commission. The business meeting then opened with H. A. Brazier, chairman of the Branch in the chair. As there was no business arising from the minutes of the previous meeting, these were adopted as read. Following the reading of the minutes of the last executive committee meeting, much discussion took place. The Association of Professional Engineers of the Province of Ontario was discussed after the secretary gave what information he had from correspondence regarding the matter. Plans were threshed out regarding speakers for future meetings, the result being that programmes were arranged for the next two meetings.

The chairman then welcomed to the Branch the following members present, who had joined the Branch since the last meeting; Robt. Angus M.E.I.C., of the C. S. Hyman Company, A. Hedley Morgan, M.E.I.C., engineer and plant manager of E. Leonard and Sons, C. J. Madgett, A.M.E.I.C., manager of the London Bridge Works, and R. J. Fuller, A.M.E.I.C. local representative of the John V. Gray Construction Company. The letter from Headquarters re mileage to Councillors was presented by the secretary. After discussion, a motion for the Branch to go on record as being in complete accord with the matter was put before the meeting and it was unanimously carried. The secretary also reported on the request of Dr. J. D. Barnett, M.E.I.C., honorary chairman of the Branch, that he be allowed to retire from his office, due to his being unable to be of any active use to the Branch. By unanimous vote of the members, the secretary was requested to write Dr. Barnett and express their wish that he retain his office. H. A. Brazier and E. V. Buchanan had prepared papers on the various points visited during the afternoon, but owing to the length of time required for the foregoing discussions, and the lateness of hour, it was proposed to have the papers presented at an extra meeting to be held October 18th. This was unanimously carried and the meeting adjourned.

Calgary Branch

J. A. Spreckley, A.M.E.I.C., Secretary.
Floyd K. Beach, A.M.E.I.C., Branch News Editor.

Owing to the absence in the field of a large proportion of the membership during the summer months, the Branch has had a recess from meetings. This recess was broken on October 9th, by a very largely attended meeting which was addressed by Lieut. Col. H. C. Boyden, representing the Portland Cement Association, who spoke on "Concrete Highway Investigations and Specifications".

The prairie provinces have as yet been unable to gc in for concrete highways. In this comparatively new country we feel that we are doing well to make less expensive road work serve until the volume of populatior will warrant greater expenditures. It was, consequently with some surprise that the greater proportion of the Branch heard from Col. Boyden figures covering the very startling growth in mileage of concrete roads in the United States and in eastern Canada. His statemen that the yardage laid in 1921 exceeded by 10 per cen all yardage laid prior to 1916, and that 1922 yardag bids fair to exceed that of 1921, was enough to call fo very careful attention from all present to the entir talk. Some lantern slides were shown illustrating method in operation for testing various types of pavement, an various devices used to increase the life of pavement.

Discussion of the paper was rather short owing t the early departure of the speaker's train. G. W. Craig M.E.I.C., occupied the chair in the absence of P. J. Jen nings, M.E.I.C., chairman of the Branch, and G. P. F Boese, A.M.E.I.C., acted as secretary in the absence o J. A. Spreckley, A.M.E.I.C.

After Col. Boyden's departure, G. W. Craig gave very interesting account of the Winnipeg meeting. H touched on the whole programme lightly and made speci mention of several features of special interest to Calgar engineers. The visit to the new Great Falls power projec

brought out the daring of the men who financed the great project, as well as the foresight and ability of the engineers who conceived it and carried the details through to a completed plant. Mr. Craig forecasted that in the not distant future Calgary will require more power than is at present available, and she will need cheap power, and reference was made to a recent pronounced by R. A. Brown before the Calgary Rotary Club in this connection. Another feature of the Winnipeg meeting that was of importance to Calgary members was the paper of Prof. Thorvaldson, on the deterioration of concrete in alkali soil. Mr. Craig recommended careful reading of the paper which has appeared in the September issue of *The Engineering Journal*.

The arrangement of a programme of meetings for the coming winter has been undertaken by a programme committee of which R. W. Craig is convenor. A very interesting programme has been planned, and it is hoped that meetings may be arranged once in two weeks. An expression of opinion favoured Monday night for meeting instead of Friday night as formerly. F. K. Beach, A.M.E.I.C., is secretary of the programme committee.

Moncton Branch

M. J. Murphy, A.M.E.I.C., Secretary-Treasurer.

The Moncton Branch held its first post summer meeting Thursday evening in the Barker house, where an enjoyable banquet was served after which W. C. McMullen of the Department of Lands and Mines for New Brunswick gave a very fine address, which was greatly enjoyed by all those present.

The address dealt with mines and minerals of the province, in which he said that the mineral wealth of New Brunswick in 1921 was placed at $1,874,000 divided as follows: Petroleum, $29,000; grindstones, $57,000; clay, $66,000; stone, $97,000; natural gas, $139,000; lime, $203,000; gypsum, $360,000 and coal $920,000. Grindstones he said were being quarried at Stonehaven, Gloucester county, but lime production in contrast to the other minerals was diminishing. Mr. McMullen quoted Dr. Bailey who had said that in New Brunswick there are many occurrences of minerals, the rocks being of various formations, most of them mineral bearing, but the covering of the soil made discovery difficult. As yet, with the exception of coal, gypsum, shale, most of the more valuable minerals in New Brunswick had been discovered in pockets only. This would not mean that they did not exist, and it was the speaker's hope that as population increased, even though the covering of the soil now made discovery difficult, valuable minerals would eventually be found.

In the first place, the speaker treated of gold. This mineral had not been found in paying quantities, and there has been little to raise the hope that it ever would.

Copper occurs in many places in Charlotte county mainland and islands, and elsewhere along the Bay of Fundy coast. Some deposits were quite rich, but the quantity was very small. Iron and copper occur along the Salisbury and Harvey railway. Some copper ore is found near Woodstock. A great deal was expected from the Dorchester copper mine where much money was spent, but the mine was closed up. At Annandale on the Kings-Queens county line, near Chipman, the Dick Brothers, have a copper mine, producing very good samples, and from this a profitable shipment was made during the war.

Hematite, (red iron ore), was extensively mined in the "forties", near Woodstock, and smelted with charcoal. The mine has long been closed and its reopening is very doubtful. The iron at Lepreau was found to be scarce, but there is a very large deposit of iron ore near Bathurst. The Drummond Company spent about a million dollars on it, and worked it for a year, shipping 80,000 tons of ore to the U.S.A. Coal was not handy for smelting, the owning company went into liquidation, and no work has been done since. It may be reworked.

Manganese, now apparently worked out, was once abundant at Markhamville, Kings county. It occurred in rock form and as bog manganese. The Markhamville works have long been closed. Some manganese was shipped during the war from Hordan mountain. During the last years of the war, bog manganese was worked at Adamsville and Dawson Settlement. That at Adamsville was surveyed by the Dominion government and reported on favourably. It was sixty-nine per cent water, nineteen per cent peat, five per cent iron and seven per cent manganese. These deposits, however, were small and are now exhausted.

Silver and galena ores are too poor to be profitably worked.

New Brunswick peat, like that of the rest of Canada, is so difficult to dry that it has not as yet been worked at a profit. Experiments were being made by the Dominion government elsewhere in Canada, and the results of these might make our peat deposits valuable.

Some years ago Tungsten was found in northern York county, near the southwest Miramichi. The ore was well defined, 150 feet about 3 feet wide being exposed, and an outcrop 650 feet distant. It assayed about one per cent, and is not now worked.

Moncton is too near the gypsum quarries of Hillsboro to need an extended description of them. There were alabaster, pink gypsum and certain lower grades in Albert county. Along with it was some anhydrate gypsum worthless for plaster. The Hillsboro gypsum industry was a stable and important one. The Tobique gypsum is of a low grade. It had been used as a fertilizer, but was not now worked at all.

A marl deposit was recently opened in southern Victoria county, where there is considerable depth of it, but nothing has yet come of it.

Infusorial earth is found at the bottoms of ponds, at Pollet lake, near the Kings-Albert line south of the Canadian National Railway; near Land's End, Kings county, and near St. John. It is used in refining sugar, as a polisher, as a filler for explosives, etc. It consists of minute shells, white when pure. The deposits have not been developed.

Graphite has been found a little south of Norton, and has been mined a little near St. John, but was too impure to be profitable.

Coal is mined in the Minto district. In the best mines there — those of the Minto Coal Company, and

Welton's — where the seam is eighteen to thirty-six inches thick, the coal is profitably mined. The Minto coal area is estimated at 112 square miles, and the Minto Coal Company have about thirty-six inches without a "bone" between the layers, and quite near the surface. They have exhausted their southern area, where they did all the work by hand, and are now working the northern mines by cutting machinery driven by electric power. Steam shovels are used in some of the mines to strip ten or twenty feet of earth off the coal. Where the coal is deeper, shaft mining is used. Some mines failed, because coal was under 100 feet of hard rock and the mining cost too much.

The Beersville coal mines are closed, being too far off the main line and the seams too thin.

Albert shale occurs in a large zone of Kings, Albert and Westmoreland. As Scotch shales has been reduced with considerable success, it was hoped that similar success would follow here. Certain New Brunswick oil shales are really very rich. If they could be found of uniform consistency and could be reduced economically, operations might be carried on with success. Thus far the reduction has not been profitable. A great deal of money has been spent lately in testing these shales. The Rosevale experimental station gets 37½ gallons of oil to the ton from some shale by using a Wallace retort. In the fissures of the Albert shales a small amount of Albertite is found, which has a very large oil content. This was once mined in Albert county, but not for many years past. It produced about 100 gallons of oil to the ton and was also used along with regular coal to increase the amount of gas produced from the latter.

Antimony was mined at Lake George, York county, as early as 1876, a large amount of ore having been taken out. It was later closed down but about four years ago it reopened and again closed. A new company has it now in hand. There is a considerable amount of ore there, consisting of stibnite with some native antimony, but reduction of the ore is difficult. The Lake George ore is about sixty-nine per cent antimony, twenty-eight per cent sulphur and eight per cent iron.

In closing, the speaker discussed many of the mining laws of the province and was of the opinion that the provincial mining laws taken without any changes from Nova Scotia, where mining was very highly developed, was a mistake in that a "search right", costing $20, gives the right to search for eighteen months, over an area two by two and one-half miles, without damage to the surface owner. If the searcher finds anything, he may then secure a "working right" over one square mile, which costs $50 per year for two years, and $25 for third year. He may then secure a lease for twenty years, renewable twice, at $50 per square mile.

He believed the law here weak in allowing any person to sell his search right and in that the searcher is not required to know there are minerals in his area before he secured his permit. In the western provinces a man must find something before he is given a 40 acre claim. In New Brunswick holders of license to search, and to work, and of twenty-year leases, may combine their claims and preempt a large territory much of which they may not be developing. However the uncertainty of New Brunswick mineral veins is an argument in favour of large areas, as illustrated by the Minto Coal Company which, when its southern areas ran out had the northern area to fall back upon. Mr. McMullen also quoted from Dr. Bailey that the surface owner should have greater priority rights.

A vote of thanks to the speaker, moved by A. S. Gunn, A.M.E.I.C., seconded by J. R. Freeman, M.E.I.C., was tendered by the acting chairman, C. S. G. Rogers. A.M.E.I.C.

Guests of honour were Magistrate C. A. Steeves, Dr. Henderson, the speaker of the evening, and representatives of the press.

At the close of Mr. McMullen's speech, vocal solos were rendered by Mrs. Harold Price, and Mr. Desire Bourque, and a piano solo by Major McKee, who accompanied both vocal numbers.

Peterborough Branch

R. C. Flitton, A.M.E.I.C., Secretary.

The first meeting of the Fall season was held on October 12th, and was addressed by George Hogarth M.E.I.C., chief engineer of the Department of Highways of the province of Ontario. The subject of the paper "The Progress of Highway Construction in Ontario" was presented in a very entertaining manner and illustrated by moving pictures and lantern views.

Mr. Hogarth emphasized the importance of our highways and explained the benefits, direct and indirect which accrued from the construction of good roads He described the work which formed the programme of the department for this year giving startling figures showing the progress which had been made during the present season. He explained how it was necessary to plan far ahead so that adequate supplies of material would be available close to the work in order that progress would be uninterrupted. He described much of the modern equipment that is necessary for efficient road making, stating that this equipment was being inproved almost from day to day. A number of excellent slides were shown depicting the high class of permanent structures which were being erected by the department Some stress was laid on the question of safety and also on beautification, and some interesting contrasts were shown of existing roads which had been made safer for traffic and at the same time more pleasing to the eye The dust nuisance was another feature which Mr. Hogarth discussed, and he said much experimenting had been done to arrive at the best cure for this trouble.

The meeting was well attended and Mr. Hogarth's instructive and interesting paper was much appreciated by the members of the Peterborough Branch.

Vancouver Branch

P. H. Buchan, A.M.E.I.C., Secretary-Treasurer.

Inspection of Sumas Reclamation Project.

The Vancouver Branch had the pleasure of accepting the invitation of the Hon. E. D. Barrow, Minister of the British Columbia Department of Agriculture, to visit the Sumas reclamation project, on Saturday, September 23rd

Owing to the uncertainty of the weather, and the necessity of devoting the whole day to the trip, the attendance of members was not as large as the executive committee hoped for, but those who did join the expedition had a real treat, which will not be easily forgotten.

A special train left the British Columbia Electric Railway's, Carroll street terminal at 8.30 a.m., with about twenty members. At New Westminster they were joined by the Hon. E. D. Barrow and F. W. Anderson, M.L.A., A.M.E.I.C., who accompanied the party to Chilliwack, arriving there at 11.10 a.m. The town clock was found to be running on standard time, which gave an extra hour to fill in before lunch. This, however, was most agreeably spent by the more active members of the party in a leisurely stroll about the town and surrounding neighbourhood, made the more delightful by the charm of the warm sunshine and beautiful scenery. When the lunch finally arrived, everyone was in good spirits and furnished with a healthy appetite, which did ample justice to the fare at the Empress hotel.

At 2.00 p.m., the party was taken in automobiles, provided by the Department of Agriculture, to a point at the junction of the Sumas river and the new channel of the Vedder, distant about thirty minutes ride. They then embarked in launches, and proceeded to inspect the new dyked channel of the Vedder for a mile or two in the southerly direction, the extent of this undertaking causing no little surprise in the minds of the visitors. After a short walk along the top of the western dyke, the party re-embarked in the launches, and were taken back to the junction with the Sumas river, where they turned west, and proceeded up the river to the site of the dam and proposed pumping plant. An interesting feature at the above mentioned junction was the barricade of nets across the Sumas river, to prevent the salmon from running up the Sumas into Sumas lake, where their valuable spawn would be lost to the salmon industry.

The party, which was under the guidance of F. N. Sinclair, A.M.E.I.C., engineer-in-charge of the project, was then conducted over the site of the dam, and afterwards given a short lecture on the general features of the undertaking, amplified by an inspection of the places and a large map of the area included in the project. A great many questions were asked, which Mr. Sinclair and his staff answered very patiently.

At 4.45 p.m. supper was served at the camp, the excellence of which far surpassed the capacity of even the most willing guests. Immediately upon the conclusion of the meal, the party commenced the return trip to Chilliwack, but not before three hearty cheers were given for the hosts, who certainly earned the gratitude of the Branch by their kindness.

The party boarded the B. C. Electric special at 6.15 p.m., which was waiting at the station, and made a fast trip home. During the journey, the chairman of the Branch, C. Brakenridge, M.E.I.C., tendered the thanks of the party to the Hon. E. D. Barrow, for the very enjoyable outing and the splendid facilities provided for inspecting the reclamation scheme to the fullest advantage. Mr. Barrow in his reply, expressed his appreciation of this opportunity to demonstrate the extent and potentialities of the undertaking to the engineering profession of British Columbia, and his very great personal pleasure in the interest which the members of the party had displayed throughout the visit.

In brief, the general problem involved in the scheme is to drain Sumas lake and surrounding low areas of rich, arable land, comprising in total about 30,000 acres, and thereafter prevent this land from being inundated during the freshet periods on the Fraser and Vedder rivers. The high water on the Fraser, which is the most formidable feature of the problem, occurs in May and June, and is due to the melting snows in the mountains of the interior. The water backs up the Vedder and Sumas rivers, which normally are insignificant streams, into Sumas lake, usually inundating the surrounding country to a depth of several feet. The freshets on the Vedder occur in November, as a rule, and are due to heavy rains in the neighbouring mountains. The stream swells to many times its normal size, and becomes a swift flowing torrent, causing serious damage to dykes by erosion. In order to immunize the latter danger, the Vedder has been diverted into a new artificial channel through the low-lying areas. The lake area will be drained by a network system of ditches to a point at the proposed dam on the Sumas river. During low-water periods on the Fraser river, the normal flow into the lake will be discharged through a spillway into the Sumas river, but during flood conditions, the spill-way will be closed, and the drainage from the lake area pumped into the Sumas river, by a very powerful electric-driven pumping plant at the dam.

Complimentary Dinner to Arthur St. Laurent, M.E.I.C.

An informal dinner was given by the Executive Committee of the Vancouver Branch and the Council of the Association of Professional Engineers of British Columbia, at the University Club, on Wednesday, September 13th, at 6.30 p.m., in honour of Arthur St. Laurent, M.E.I.C., chief engineer of the Department of Public Works, Ottawa. Notwithstanding the somewhat hurried arrangements, necessitated by short notice, the occasion proved most enjoyable, much of the success being due to the skill and genial personality of Wm. Smaill, M.E.I.C., who discharged the double duties of chairman and host.

Mr. St. Laurent visited Vancouver in company with the Hon. Dr. J. H. King, Minister of Public Works. during his recent tour of British Columbia in respect of the affairs of his department. This fact was commented upon, as being quite apart from the customary procedure of Ministers of Public Works, their habit in the past being to omit the chief engineer from the personnel of their parties on such tours of inspection. The policy of Dr. King, in this particular, commended itself to those present at the dinner, as being a thoroughly business-like and common-sense practice, demonstrating the Minister's clear understanding of the relationship of the engineer to the works under his professional supervision, and adding new dignity to the office of chief engineer of the Department.

In acknowledgement of the complimentary remarks of the chairman and a number of the other gentlemen present, Mr. St. Laurent expressed his keen pleasure in having this opportunity of meeting brother engineers in

British Columbia at such an informal and enjoyable gathering and assured him that any who visited Ottawa would be very warmly welcomed at his department. He also said that it would give him very great pleasure to take the greetings of the Vancouver Branch, extended by Branch Chairman, C. Brakenridge, M.E.I.C., to the Ottawa Branch of *The Institute*.

The dinner was attended by the following gentlemen: Wm. Smaill, M.E.I.C., Vancouver, Arthur St. Laurent, M.E.I.C., Ottawa, C. Brakenridge, M.E.I.C., Vancouver, D. O. Lewis, M.E.I.C., Vancouver, A. C. Eddy, M.E.I.C., Vancouver, A. E. Foreman, M.E.I.C., Vancouver, E. G. Matheson, M.E.I.C., Vancouver, W. G. Swan, M.E.I.C., Vancouver, J. A. Dawson, Vancouver, P. H. Buchan, A.M.E.I.C., Vancouver, P. Philip, M.E.I.C., Victoria, E. E. Brydone-Jack, M.E.I.C., Victoria, C. C. Worsfold, M.E.I.C., New Westminster, E. H. Verner, Port Coquitlam, A. D. Swan, M.E.I.C., Montreal.

Second Narrows Bridge

During July last, it was brought to the notice of the Executive Committee of the Vancouver Branch, that public approval was being sought by the Burrard Inlet Tunnel and Bridge Company of a contract with the McClintock. Marshall Construction Company, of Pittsburg, Pa., for a bridge across the Second Narrows. There being some doubt as to whether the services of a qualified independent engineer had been retained by the Burrard Inlet Tunnel and Bridge Company, it was deemed advisable, by the Executive Committee of the Branch, to appoint a special committee to investigate this question in the interests of the public.

The special committee's deliberations resulted in the drafting of a questionnaire, to be forwarded to the Burrard Inlet Bridge and Tunnel Company, which was amended and approved by the Executive Committee on Monday, July 31st. This was duly forwarded to the secretary of the said company, who replied to the letter on August 3rd. Shortly afterwards, it was announced by the company that A. D. Swan, M.E.I.C., had been appointed as consulting engineer, thus rendering further functioning of the committee unnecessary.

Town Planning

During September, an active committee on town planning was formed, consisting of two representatives from each of the councils of Vancouver, North Vancouver, New Westminster, Point Grey, South Vancouver and Burnaby; also two delegates each from the Vancouver Board of Trade, Vancouver Real Estate Exchange, *The Engineering Institute of Canada*, the Architectural Institute of B. C. and the Trades and Labour Council. The delegates from the E.I.C. were C. Brakenridge, M.E.I.C., and W. B. Young, A.M.E.I.C., the chairman of the committee being alderman T. H. Tracy, M.E.I.C., of the Vancouver city council.

The immediate purpose of the committee was to draft a proposed Town Planning Act, modelled on the suggestions of Professor T. H. Adams, received a year ago and closely following the Saskatchewan Act. This matter was placed in the hands of a sub-committee, with C. Brakenridge as chairman, to draw up and handle the details of the proposed Act, all technical members of the general committee lending active assistance to obtain a well-considered measure for submission to the provincia government at the next session of the legislature.

The efforts of this committee were rewarded by the proposed Act receiving the endorsation of the Union o British Columbia municipalities at its annual conventio held in Kamloops recently. Some opposition has develop ed, however, from the city of Vancouver's legal depart ment, which holds the opinion that the proposed Act wil cause considerable confliction with existing legislation a embodied in the Land Registry Act, the Municipal Ac and the Vancouver Incorporation Act. Notwithstandin this, it is confidently hoped that really serviceable an comprehensive legislation will be secured to enable th municipalities to avoid many of the pit-falls which occu through the present hap-haggard methods of dealing wit the town planning problems arising in this rapidly grow ing province.

Niagara Peninsula Branch

R. W. Downie, A.M.E.I.C., Secretary-Treasurer.

The Niagara Peninsula Branch opened its season b a dinner at the Welland House, St. Catharines, on Frida October 20th, 1922, at 7.15 p.m., which was participate in by about forty members and friends. After a sho sing-song, the guest and speaker of the evening, Cap T. S. Scott, city engineer of Niagara Falls, Ontario, rea a most interesting paper on "Roads".

The subject was opened by Jeffrey Farnol's intro duction to the "Broad Highway", afterwards Mr. Sco touched on the historical side, showing that the wid spread use of roads, as we know them, is comparativel modern, the macadam road being developed with th coming of the stage coach. The advent of railwa delayed further advance in the science of road constru tion, until the arrival of the automobile, which has ma road construction an entirely different problem to wh it formerly was. Mr. Scott then mentioned vario materials used for surfacing, and stated that no resear work worth mentioning, on the subject had been do and it was badly needed; also that none of the colleg had taken up the science of road construction until ju lately.

A hearty vote of thanks, proposed by A. J. Gra and seconded by W. P. Near, was unanimously extend to the speaker by F. S. Lazier, chairman, who stat that the paper was the ideal they had been looking f popular and not entirely technical.

Cape Breton Branch

Kenneth G. Cameron, A.M.E.I.C., Secretary-Treasure

A regular monthly meeting of the Branch was h on October 10th, at the Branch rooms in Sydney, wh a paper on "Present day practice in concrete constructio by K. G. Cameron, B.Sc., A.M.E.I.C., and S. C. Miffl B.Sc., A.M.E.I.C., was read by Mr. Cameron. The atte ance was unusually large, a number of interested visit being present.

The writers stated explicitly that their paper de with the construction side of the concrete problem, rat than the design, and that no attempt had been made

nclude any original matter, but that the paper was prepared as a brief summary of the latest information on the subject, all available sources of information being consulted as far as possible. The primary object of this paper was to promote greater confidence in the use of concrete, by showing the precautions necessary in the selection and use of the raw materials in order to obtain the best quality of finished product. The subject was taken up under four heads; raw materials, working stresses, inspection and construction. In dealing with the question of fine aggregate, stress was laid on mechanical analysis, and the impossibility of correct visual judgment was illustrated by means of actual samples, separated by standard sieves, and recombined in varying proportions. Under working stresses the matter of foundation loading was considered, and the writers remarked on the frequent unwillingness of employers to make the small expenditures necessary for preliminary survey work, and the handicap which is often thereby placed upon the designer, who generally has to take the blame for subsequent failures or exceeded estimates.

In making a plea for better quality of concrete work the writers said:—"The point to realize is that no amount of care in designing will avail unless every precaution is taken in construction. It is up to the engineer, — he spends his life studying how it should be done, — and it is up to him to see that it is done the right way. His own reputation, and by reflection, that of the profession, will grow or disappear accordingly. In every case the public exercises its judgment in selecting its professional man, but having selected him, it has to have confidence in him, and take his advice. When an engineer is consulted or employed to direct engineering work, his advice should be final. This applies particularly to concrete work, — for as one of the most abundant and commonly used of building materials, the general public has an idea that there is really nothing to it, — we know that there is really a great deal to it, and it is up to us to show the public that concrete is worthy of as much respect as any other material, and that their money will be more wisely spent if they seek and take the advice of the men whose business it is to know about it."

At the conclusion of the paper, considerable discussion took place, during which the results of different experiences were exchanged. A vote of thanks was tendered to the authors of the paper, and after which the meeting was adjourned.

OTHER SOCIETIES NEWS

Report of Representative, Calvin W. Rice, at the International Engineering Congress

Rio de Janeiro, Brazil, September 16, 1922.

The Engineers Club of Rio de Janeiro enjoys a position of influence quite beyond that of any engineering body in the United States. The President, Conde de Frontin, is an engineer of great distinction who has rendered service to his country in crisis and is also politically powerful. (He also has a box in the grand tier at the opera.) The Club owns its own building, of imposing architecture, on the principal street, Avenida Rio Branca, on the corner of Rua de 7 Setembro. It was the only organization in all Brazil to present an address to the Secretary of State, Hon. Charles E. Hughes.

Your representative was most fortunate in having been able to secure passage on the S.S. Pan America and in turn to have several pleasant interviews with Mr. Hughes and acquaint him with the engineer's program. The other representatives on the steamer from the societies were Col. Marshall W. Brown, member American Society of Civil Engineers and Dr. T. T. Read, member A.I.M.E. At the Captain's dinner, Sunday evening, before coming into port, your representative was requested by the passengers to preside to express the great appreciation of all to Captain Rose for his most excellent service and passage and to introduce the Secretary of State of the United States.

Owing to the lateness of the undertaking of the Congress and the arrival only to-day of papers from the United States, the program of the sessions has not yet been developed. On account of the incompleteness also of the Exposition itself, however, the really extensive collection of films of all manner of industries are destined to prove of great value to the people at large in connection with the Centennial Celebration owing to the lack of exhibits. Thus the very object of the Engineering bodies has been obtained, namely, of rendering a definite service within their own field. This is true throughout life that every person and every organization has right at his door the opportunity to render peculiar and effective service.

(*Signed*) CALVIN W. RICE.

Canadian Institute of Chemistry

The Council meeting of the Canadian Institute of Chemistry, was held on September 20th, at the headquarters of *The Engineering Institute of Canada*, in Montreal. At this meeting it was definitely decided to work out an organization on a professional basis. Already there is established the Maritime branch including three eastern provinces, and also a branch at Kingston, Ontario. It is further proposed to hold immediately, organization meetings in Montreal, Ottawa, Toronto and Kingston. In addition to this the Institute is negotiating with the Manitoba Chemical Society and it is anticipated that in the near future western branches may be established. Already the membership, including the leading chemists in these provinces, is at present two hundred and seventy-seven.

Steps have already been taken to create a class of Local Members, thereby satisfying the requirements of individuals who could not qualify in an academic way. These adherents will have no general vote in the affairs of The Institute and will pay a nominal sum to the local branch. The Institute is also undertaking to represent Canada in the International Chemical Union, and in this way Canadian chemists of prominence are being appointed on an international committee of research.

The legislation committee is preparing a model Bill for the use of chemists in any province where it may be desirable to seek legislation.

American Society for Testing Materials

The 1922 edition of the A.S.T.M. Tentative Standards, which has been published annually, has recently been issued. This volume contains:—steel, wrought and cast iron, (18); non-ferrous metals, (13); cement, lime, gypsum and clay products, (27); preservative coatings, (15); petroleum products and lubricants, (13); road materials, (35); coal and coke, (4); waterproofing, (9); insulating materials, (5); shipping containers, (4); rubber products, (12); textile materials, (4); miscellaneous, (4).

By way of explanation it may be said that the term "tentative standard" as distinguished from "standard" is applied to a proposed standard which is printed for one or more years with a view of eliciting criticism, of which the committee concerned will take due cognizance before recommending final action toward the adoption of such tentative standards by formal action of the society.

The society is prepared to supply copies of this volume upon request at a cost of seven dollars per volume in paper binding, and eight dollars per volume in cloth binding.

American Association of Engineers

Reciprocity in the Practice of Professional Engineer

The Council of State Boards of Engineering Examiners representing sixteen states in conference, on October 2nd and 3rd, at the Congress hotel, Chicago, agreed upon rules for the reciprocal registration of professional engineers. These rules provide that an engineer registered in one state may be permitted to practise in other states which are parties to the reciprocal registration agreement. The articles of agreement as prepared will become operative as soon as signed by the various boards.

Reciprocal registration with Canada and Mexico was provided for in the appointment of an investigating committee. Since the present time engineers going into Canada cannot practice unless registered in Canada.

Toronto Engineer Alumni Re-Union

The fourth annual re-union of the Engineering Alumni Association of the University of Toronto was held on Friday and Saturday, October 27th and 28th. The program consisted of class re-unions, dinner dance, attendance at football game, faculty reception, and re-union dinner along with private social entertainment, such as motoring, golfing, etc.

Class luncheons were held at noon on Friday by the respective years, at such locations as Hart House, Engineers', University and other local clubs, and by the numbers in attendance the change of this event from Saturday to Friday noon, seems to have been a very wise suggestion on the part of the Organizing Committee. The dinner dance which was well attended, was held in the Crystal Ball Room of the King Edward hotel on Friday evening at 7.00 p.m., and was a brilliant affair. On Saturday morning the annual meeting of the alumni was held in the Chemistry and Mining building, when general business relating to the Engineering Alumni, University of Toronto, was transacted. A buffet luncheon at 12.30 p.m., immediately followed the annual meeting. This was a get-together time for all School graduates to renew acquaintances. Out-of-town members of the alumni were the guests of the Toronto representatives.

Queens-Varsity football game was attended in a body by some three hundred members of the engineering alumni. A novel burlesque intermission performance was staged during the game by the engineering undergraduates of the Faculty of Applied Science. At 4.30 p.m., a very pleasant faculty reception was held in the thermo' building, where the wives and friends of all the alumni visitors spent a social hour together.

The big event — the annual dinner, — was held at 7.30 p.m., in the large hall immediately adjoining Convocation building, and was a huge success. Dr. A. C. Humphreys of the Stevens Institute of Technology, Hoboken, N.J., was the chief speaker of the evening, replying to the toast, "The Engineering Profession" proposed by A. V. Trimble, '04, chairman of the Organizing Committee of the Engineering Alumni Association. T. Arthur Baker, professional entertainer of New York, lead the singing and entertained the audience during the entire dinner. The undergraduates of the Faculty of Applied Science staged a very interesting programme in amateur boxing and fencing bouts, along with vocal selections.

The general expression heard on all sides during the dinner proved that these re-unions are now being looked forward to by all graduates of the Faculty of Applied Science, as an annual event.

Through the generosity of the Board of Directors of the Engineers' Club of Toronto, all out-of-town members of the alumni had the privilege of the use of the club during the two days' re-union. The privilege was greatly appreciated and the club rooms acted as a general rendezvous for "Toike-Oike" men from all parts of Canada.

E. DEVILLE, LL.D., D.L.S., F.R.S.C., Hon. M.E.I.C.

Preliminary Notice

of Applications for Admission and for Transfer

19th October 1922.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in November, 1922.

FRASER S. KEITH, Secretary.

*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course. In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option, Railway, Municipal, Hydraulic, Mechanical, Mining or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects: Geography, History (that of Canada in particular), Arithmetic, Geometry, Euclid (Books I.-IV. and VI.), Trigonometry, Algebra up to and including quadratic equations.

Every candidate for election as ASSOCIATE shall be one who by his pursuits scientific acquirements or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge.

> **The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members.**

ADAMS—ANDREW HEPBURN SYME, of 26 Balsam Avenue, Toronto, Ont. Born at Hamilton, Scotland, Sept. 28th, 1883; Educ., B.Sc. (Eng.) '13 and M.A., Glasgow Univ., Scotland; 1911-13, surveying, levelling, constrn. of roads and streets, preparing surveys and plans under A. V. Wilson, B.Sc., A.M.I.C.E.; 1912-13, calculating stresses, aiding in compiling steel handbook, Redpath Brown & Co., Glasgow; 1914 (summer), inspector, sewers and sidewalks (constrn.), St. Lambert, Que.; 1915-16, teacher of applied mechanics and strength of materials, Central Tech. School, Toronto; 1916-19, O.C. "B" Coy., 2nd Battn. Can. Rly. Troops, in chg. constrn. light and standard gauge rlys., over Ypres-Paschendael, Bapaume-Cambrai and Peronne fronts; Nov. 1918, resumed position in Central Tech. School, Toronto to date.

References: J. B. Carswell, M. B. Watson, R. O. Wynne-Roberts, C. P. Van Norman, J. M. Gibson.

BAYNE—GEORGE MANNING, of 186 Rosslyn Ave., S., Hamilton. Born at Bridgeton, B.W.I., July 24th, 1886; Educ., 1902-04, science course, Harrison's Coll., Barbados, and 1907-10, Queen's Univ., Kingston; 1911-18, dftsman, Canadian Westinghouse Co., Ltd.; 1918 to date, engr., heating division, Canadian Westinghouse Co., Ltd., Hamilton, Ont.

References: H. U. Hart, W. F. McLaren, H. B. Dwight, J. Erskine, E. M. Medlen.

CAMSELL—CHARLES, of Ottawa, Ont. Born at Fort Liard, N.W.T., Feb. 8th, 1876; Educ., B.A., Univ. of Manitoba, '94, post graduate work in Geology, Queen's Univ., and Harvard Inst. of Technology; 1901, geologist, Can. Nor. Rly.; 1904-20, geologist, Geological Survey of Canada; 1920 to date, Deputy Minister, Federal Dept. of Mines, Ottawa, Ont.

References: K. M. Cameron, C. P. Edwards, G. A. Mountain, L. H. Cole, A. St. Laurent, G. B. Dodge.

GRONAU—WILLIAM FREDERICK, of Montreal, Que. Born at Baltimore, Md., U.S.A., July 9th, 1866; Educ., C.E., Rensselaer Poly. Inst., '87 and Baltimore City Coll.; 1887-89, inspectr. structr'l. steel work and asst. engr., G. W. Ferris & Co., Pittsburgh, Pa.; 1889-95, member of same firm in chg. engr'g. dept.; 1896-99, asst. engr., Edge Moor Bridge Works, Wilmington, Del.; 1899-02, in chg. design and constrn., buildings, wharves, etc., New York Shipbuilding Co., Camden, N.J.; 1902-11, chief engr., J. N. Gray Co., constr'tg. engrs., New York; 1911-13, secy., Gronau-Campbell Co., contr'tg. engrs., New York; 1913-14, engr., Structural Engr'g. Co., Montreal; 1914 to date, contr'tg. engr., Dominion Bridge Co., Ltd., as follows:—designed Ferris Wheel, World's Columbian Exposition, Chicago; consltg. engr., Highway Bridges over Ohio River at Wheeling W.Va., and Cincinnati, O., and Newport, Ky.; 9th St. Bridge at Pittsburgh and Rly. Bridges for Chicago and Eastern Illinois R.R.; in complete chg. all civil engr'g. wk. on constrn. of plant of New York Shipbldg. Co.; in chg. of erection and engr'g. Erie R.R. Ferry Terminal, N.Y.; extensn. Brooklyn Bridge, N.Y., therein fixing towers of Williamsburgh Bridge, N.Y., Interborough Rapid Transit Rly. Injection Sheds, N.Y., round house and coaling stns., and overhead crossings at Harmon, N.Y., for N.Y. Central Rly.; designed steel work for New Amsterdam and Liberty Theatres, N.Y., shops at Quebec for Transc'l. Rly.

References: G. H. Duggan, P. Johnson, F. P. Shearwood, S. J. Chapleau, F. C. McMath, G. F. Porter, R. S. Buck, W. A. Duff.

MACDONALD—REDMOND DONALD, of Ottawa, Ont. Born at Goderich, Ont., Nov. 16th, 1883; Educ., S.P.S., Toronto, '05, School of Mines, Queen's '06, Renss. Poly. Inst., Troy, N.Y., '09; 1904-07 (except time at college), chainman and rodman, Guelph and Goderich Rly.; six mos., asst. engr., in chg. six miles constrn., Linwood & Listowel Rly. Branch Guelph and Goderich, R. C. Harris, divn. engr.; 1907-09, engr., Canton and Hankow Rly., on constrn. and location, South China; 1910-13, res. engr., Alberta Central Rly.; 1913 to date, engr., Forestry Branch, Dept. of the Interior, Ottawa, Ont.

References: B. L. Thorne, J. C. Brown, T. H. G. Clunn, B. J. Forrest, H. R. Cram.

McLAREN—WILLIAM ALFRED, of Charlottetown, P.E.I. Born at Brudenell, P.E.I., July 31st, 1886; Educ., High School; 1905-06, axeman and rodman, Prince Edward Island Rly.; 1907-08, axeman, Transcontinental Rly.; 1908-15, Instr'mn. on different residencies, districts A. and E.; 1916-17, Lieut. 105th and 104th Infantry, C.E.F.; 1917-19, constrn. light and standard gauge rlys., Lieut., 7th Can. Rly. Troops; 1919-21, res. engr., on highway constrn., Prov. Govt., P.E.I., at present instr'man., C.N.R., Charlottetown, P.E.I.

References: H. H. Shaw, A. Scott, C. O. Foss, A. S. Gunn, R. H. Cushing, H. M. Armstrong.

O'NEILL—GEORGE, of Waterloo, P.Q. Born at Cardiff, Wales, May 22nd, 1892; Educ., home study in civil engr'g. and naval architecture; 1912-14, chainman, rodman and instr'man., on Transcontin'l. Rly.; 1915-16, efficiency engr., plant reorganization, Ross Rifle Co., Quebec; 1916 (May-Sept.) full chg. design and constrn., in re-modelling 4 Great Lake steamships on plant R. Palmer & Sons, Noark, Conn.; 1916-18, contracts on steel ships at plants—Lake Torpedo Boat Co., Bridgeport, Conn,, Rice Bros., E. Boothbay, Maine, Gas Engine & Power Co., Morris Heights, N.Y., and Kyle Purdy Inc., City Island, N.Y.C.; 1919-20, genl. supt., Greenport Ship Co., Inc., Greenport, N.Y.; to date, section engr., in chg. constrn., Montreal Sherbrooke Highway, Eastman to Richelieu, Dept. of Roads, Quebec.

References: A. Dick, C. A. Buchanan A. Ferguson, A. C. Fellows, E. A. Evans.

READ—GUY CARLETON, of 613 St. Joseph Str., Lachine, Que. Born at Kenora, Ont., July 10th, 1883; Educ., Lindsay Collegiate and I.C.S. in electr'l. engr'g.; 1901-05, Canadian General Electric Co.; 1905-07, asst. engr. in chg. installn. and operation of Rotary Converters for Toronto Str. Rly.; 1907-09, asst. to engr. in chg. installn. and operation substations; 1909-10, elec. engr. and supt., Cobalt Light, Power & Water Co.; 1910-16, elec. engr in chg. installns. as follows:—1910, City of London Substation; 1911-14, erect'g. 5 generators Shawinigan Water & Power Co., Shawinigan Falls; 1914 and 1915, erect'g. 3 generators and 2 synchronous condensers; 1915, installing complete electr'l. equip'mt. for Eugenia Falls plant; 1916, install'g. electr'l. switching and control equip'mt. for 6 generators; 1916-17, in chg. electr'l. installns., Shawinigan Water & Power Co.; 1917-20, asst. consltg. engr., J. M. Robertson, Ltd.; 1921 to date, elec'l. engr., Fred Thomson Co. Ltd., Montreal.

References: J. C. Smith, J. M. Robertson, J. H. Hunter, F. Thomson, C. J. Desbaillets, G. E. Templeman, F. H. Farmer.

SINCLAIR—GEORGE EDWARD BLAKE, of Ottawa, Ont. Born at Morden, Man., Oct. 27th, 1894; Educ., B.Sc. (C.E.), Univ. of Manitoba, '22; 1913 to date, with Geodetic Survey as follows:— 1913-14, rodman; 1915-17, recorder and asst. to D. McMillan, A.M.E.I.C.; 1918, asst. to F. B. Reid; 1919, classified as geodetic engr., by Civil Service Comm.; 1919, in chg. geodetic survey party in prov. of Quebec and 1920-22, in prov. of Ontario; at present, geodetic engr., Geodetic Survey of Canada, Dept. of the Interior, Ottawa, Ont.

References: E. P. Fetherstonhaugh, J. N. Finlayson, N. M. Hall, J. N. Ogilvie, F. B Reid, J. L. Rannie, G. L. Guy.

SYMES—CYRIL BARRON, of Fort William, Ont. Born at Winnipeg, Man., May 10th, 1888; Educ., Collegiate Inst., Fort William and I.C.S.; 1905-06, rodman with preliminary survey on constrn. of Kakabeka Falls development of Kammistignia Power Co.; 1906-16, instr'man. to asst. engr. under H. S. Hancock, Jr., and R.R. Knight, on constrn., reservoirs, tile and concrete sewers, street rlys., concrete bridges and pavements, engr'g. dept., City of Fort William; 1916 to date, city engineer of City of Fort William, Ont.

References: R. W. Leonard, H. S. Hancock, Jr., T. H. Byrne, R. R. Knight, L. M. Jones, H. B. R. Craig, W. T. Moodie, D. G. Calvert, J. Antonisen, E. W. Robison.

TILSLEY—RICHARD FRANK, of Moose Jaw, Sask. Born at Shavington, Cheshire, England, Aug. 2nd, 1890; Educ., Crewe Academy to 1904, Crewe Mech. Inst., 1904-11, and Durham Univ., '19; 1904-11, appr'tce., Crewe Locomotive Wks., London & North Western Rly. Co.; 1911-15, practical mining in Peru, S.A.; 1915-18, on active service; 1918-19, Armstrong College; 1920-21, mech. and mining engr., Cerro de Pasco Copper Corp., Cerro de Pasco, Peru, S.A.; 1921 to date, asst. engr., City Engineer's Office, Moose Jaw, Sask.

References: G. D. Mackie, J. R. C. Macredie, W. H. Greene, M. Sinclair, J. D. Peters.

WRIGHT—HARRY, of 34, Herbert Ave., Toronto, Ont. Born at Hull, England, June 20th, 1891; Educ., 3 yrs. Tech. Coll., Hull, England; 1911, dftsman., Toronto Structural Steel Co.; 1911-13, Canada Foundry Co.; five years, checking, designing all classes structr'l. steel and bridge work, both highway and railroad, all drfting and engr'g., McGregor & McIntyre, Ltd., Toronto., also complete chg. of drafting and engr'g. dept., Hepburn & Disher, Ltd.; at present, designer and checker, in drafting dept., McGregor & McIntyre, Ltd., Toronto.

Reterences: E. T. Bridges, A. R. Robertson, F. M. Byam, G. P. Wilbur, H. Raine.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

ALLINGHAM—RALPH, of Kroonstad, South Africa. Born at Woodstock, N.B., Oct. 19th, 1891. Educ., 3 yrs. science, McGill Univ, and 1 yr. arts; 1911 (5 mos.), rodman C.P.R.; 1912 (5 mos), dftsman, rly location St. John & Quebec Rly.; 1913 (5 mos.), leveller and topogr., St. John & Quebec Rly., and Aroostook Valley Rly.; 1913-14, instr'man, John S. Metcalf Co., St. John, C.P.R. Elevator; 1914 (Feb.-Aug.), instr'man, on St. John Docks, E.G.M. Cape; 1914-15, asst. supt., repairs and alterations to conveyors and elevators, St. John, John S. Metcalf Co.; 1915 (July-Oct.), instr'mn., on powder plant, Drummondville, Westinghouse Church Kerr Co.; 1915-16, (3 mos.), foreman at Grenville Lake Mines for Scottish Can. Mag. Co.; 1916-17, res. engr., on constrn. concrete bridges, Mecca Constr. Co., Morristown, N.Y.; 1917-21, res. engr., Foundation Co., Ltd.; 1921 to date, engr. in chg. constrn., country elevators in South Africa, A. W. Menkins, Durban, South Africa.

References: R. E. Chadwick, C. W. Allen, L. C. Jacobs, H. Rolph, J. Robertson, S. C. Mifflen, J. A. Grant.

WHITEHOUSE—LLOYD AMOR BLACKFORD, of 192, Herkimer Str., Hamilton, Ont. Born at Hamilton, Ont., June 1st, 1896; Educ., 3 yrs. Hamilton Tech. School, elec. and mech. design'g. course, and I.C.S., civil engr'g. course; 1915-16, chainman, rodman and dftsman., and genr'l. office work, MacKay, MacKay and Webster, and 1916-19, on city surveys, genr'l. municipal work, transitman, and chg. of parties on sub-division work; 1919-20, dftng., final plans for report to Govt., Beach developments—design, dftng., and calculations, under J. E. Hollaman, Hamilton Harbour Commission; 1920 to date, work in layout of bldgs., as asst. to J. A. W. Brown, chief engr., W. H. Yates Construction Company, Ltd., Hamilton, Ont.

References: A. R. Macpherson, J. A. Brown, J. E. Hollaman, E. R. Gray, J. M. Wilson, E. H. Darling, J. J. MacKay, F. W. Paulin, W. B. Ford.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

EVANS—MAURICE JOHN, of Belvedere, Alta. Born at Clacton-on-Sea, England, May 3rd, 1900; Educ., Univ. School, Victoria, B.C., 1907-17, and Diploma, R.M.C., '20; 1917 (June-Sept.), chainman, picketman and axeman, B.C. Land Survey; 1919 (June-Sept.), chainman and picketman, B.C. Land Survey; 1920 (June-Nov.), plane table work and land classification, Dom. Govt. Irrigation Surveys in Southern Alberta; 1920, (Nov.-May)-21, junior engr., design of irrig. systems; 1921 (May-Nov.), plane table work as asst. M. H. Marshall on dam site work and pumping machines; 1921 (Nov.-May)-22, design of dams, pumping plans and genr'l. irrig. structures; 1922 (May-July), transitman, to M. H. Marshall, of Main Canal location on N. Saskatchewan Irrig. Project; to date, on private enterprise, reclaiming land by drainage, Belvedere, Alta.

References: M. H. Marshall, B. Russell, G. H. Whyte, F. K. Beach, D. Whittaker.

McCAFFREY—WALTER RAYNER, of Toronto, Ont. Born at Box Grove, Markham, Ont. June 23rd, 1894. Educ., B.A.Sc., Univ. of Toronto, '15; 1914 (6 mos.), instr'man, Irrigation Office, Dept. of the Interior, Calgary, Alta., and 1916, with same dept., in chg. hydrometic party; 1916-19, with Can. Imperial Forces in France and England; 1919 to date, sales engr., in chg. engr'g. dept., National Fireproofing Co. of Canada, Ltd., Toronto, Ont.

References: C. Hertzberg, P. Gillespie, T. R. Loudon, P. Wilbur, N. H. Mason, R. S. C. Bothwell W. W. Gunn, W. P. Near.

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Relay Protection for Radial Transmission and Distribution Systems

A New Principle of Protection developed for the 50,000-volt 30-cycle Transmission System of the Shawinigan Water and Power Company.

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Paper read before the Montreal Branch, The Engineering Institute of Canada, November 16th, 1922.

The customary practice of protecting a radial distributing system is to provide excess current relays with selective time adjustments. This principle of protection is based on the assumption that under any short circuit condition the current in the faulty line will exceed the normal load current. This excess current is used to actuate a current relay, which in turn trips the line circuit breaker, thus disconnecting the faulty line. Systems with several substations in series have a time delay feature on the current relays of the various stations. This time delay is made shortest on distant feeders and is gradually increased toward the power house and reaches the highest time setting at the power house. Such system of time settings will give distant feeders a chance to clear on trouble ahead of main feeders closer to the power house, even if the short circuit current should be sufficient to start to actuate the excess current relays of the main feeders.

Thus, the present principle employed makes use of the excess current in the line to indicate the abnormal condition of a short circuit, whereas selectiveness of tripping is obtained by time delay difference on relays of switches located in series to each other between the point of fault and the generating station. This principle of protection is found to be entirely inadequate for transmission systems where the whole generating capacity is fed out over a few long lines, as will be discussed hereafter.

The purpose of this paper is to point out the weaknesses of the excess current principle and to describe a new principle of protection which overcomes the objectionable features of the present excess current principle. The new principle makes use of the fact that a short circuit does not only manifest itself by excess current but also by low voltage. This fact is made use of so as to obtain a selectiveness of switches located in series, not only by time selective setting, but by a relay which will respond only if the relay is located close enough to the point of short circuit, so that the voltage at that point is so low as to offset the relation between voltage and current sufficiently to actuate the relay. This will be more clearly understood from the description given later in the paper.

The development of this new principle was forced upon the writer by the fact that the system under consideration had particularly pronounced characteristics, which made the application of the excess current protection hopeless. The paper will give a graphic description of the observations which lead to the realization of the inadequacy of excess current protection. It will show how sustained short circuit currents may drop near or below normal load current so that overload relays of settings in excess of normal load current become useless.

The 30-Cycle Shawinigan System and its Characteristic Features

Figure No. 1 shows a schematic single-wire diagram of the 30-cycle transmission system. The system is one of the oldest existing, transmitting power at 50,000 volts. The power is generated at Shawinigan Falls as 2,200-volt, 2-phase current. It is stepped up, at the power house, to 50,000-volt, 3-phase current, and as such is transmitted over 150,000 c.m., aluminum lines.

The system is particularly characteristic by the comparatively large load of 25,000 kw., being transmitted over a distance of 110 miles with the small size conductor

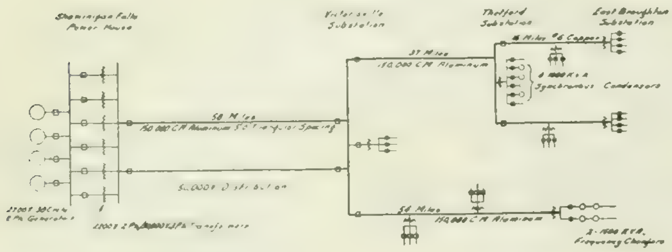


Fig 1 Schematic Diagram of 30 Cycle System

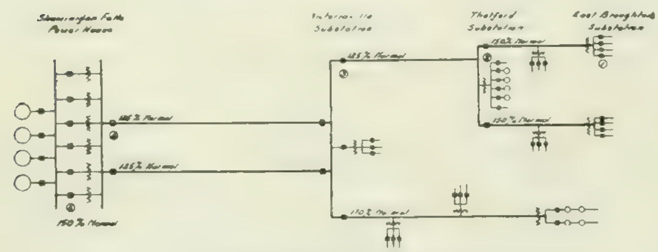


Fig 2 Diagram of 30 Cycle System.
Showing Current Settings of Excess Current Protection used on Various Lines Expressed in % of Normal Maximum Load Current

Figures Nos. 1 and 2.

and the comparatively low transmission voltage, the voltage drop under normal load being nearly 30 per cent. These features are particularly responsible for the rather limited short circuit current in case of distant short circuits.

The generator capacity is liable to vary between 12,000 kv.a., and 35,000 kv.a., depending on load conditions, so that during light load conditions line shorts may be limited as to current magnitude on account of limited generator capacity. Two parallel transmission lines are feeding Victoriaville. If ever one of these lines is taken out of service, the total reactance between Shawinigan Falls and Victoriaville doubles and as a result causes a further limiting of the short circuit current in case of short circuits beyond Victoriaville. From the above can be seen that this system has several features which tend to limit the short circuit current.

History Leading to the Development of the New Protection

Toward the end of 1918 a careful investigation was started on the system in question in an endeavour to improve the relay protective system. Up to that time ordinary bellow type overload relays were employed with varied success. The result of the investigation led to the decision of equipping the main system with a time selective excess current protection, consisting of modern inverse definite time relays of great accuracy and reliability.

Time Selective Excess Current Protection

The serious short circuit current limitation in case of distant line shorts and under certain operating conditions was then already realized, but no effective means were then known to assure the same protection for all operating conditions. As a result a protection was developed which would offer fair effectiveness during heavy load conditions. In our endeavour to improve the ordinary time selective protection a combination of time limit and instantaneous relays was provided on each line. One set of relays consisted of the customary inverse definite time relays, set so as to be time selective with switches in series. The other set consisted of instantaneous excess current relays of such high current setting that they would only respond to short circuits very close to their respective station.

This combination protection assured quick clearance in case of most serious shorts. Such rapid clearance was essential in order to limit the damage at the point of fault and also to limit the seriousness of the disturbance, particularly in view of the sensitive synchronous load of the system. The combination protection also permitted shorter time settings, which was particularly essential in order to obtain at least some effectiveness from the excess current protection. The settings were governed by the following considerations:—

(a) The current setting of each time limit excess current relay must be in excess of the maximum load current of the respective line. This is necessary so as prevent normal load current to actuate the relays. Figure No. 2 shows the current settings of the relays of the various line switches in relation to the normal load current of the respective line. Ordinary practice considers a current setting of at least 1.5 to 2 times normal, as minimum permisseble current setting to avoid wrong tripping on account of mementary overload. Figure No. 2 indicates that most lines were provided with a current setting of less than 1.5 times normal load current. These low current settings were somewhat dangerous but it was realized that they were essential, if at least some good should result from the protection due to the limited short circuit current to be expected.

(b) The time curves of the various relays were adjusted in such a way that under maximum short circuit condition, under which two switches had to function time selective, the switch closer toward the

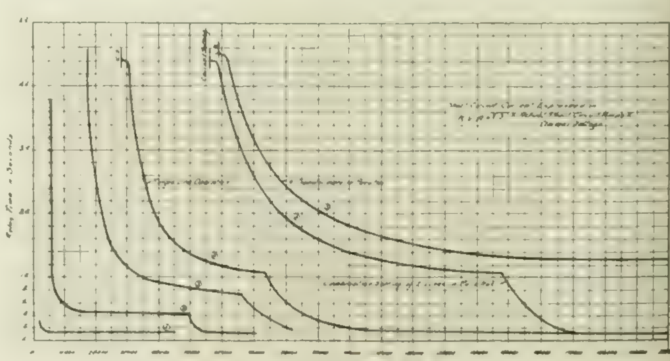


Fig 3 Time Curves of Excess Current Protection

Fig 4 Sustained Short Circuit Currents Under Most Limited Conditions.

Figures Nos. 3 and 4.

power house was given about 4/10th of a second additional time lag. Such time difference is necessary to allow a switch to rupture the current before the next switch toward the power house may be released by the relay protection. With the combination protection of inverse time setting for limited shorts and instantaneous settings for heavy shorts, the critical condition for time selective action exists always under a short circuit condition, which reaches a current value of the magnitude of the current setting of the instantaneous excess current relay.

This may be more clearly understood from an example. Figure No. 3 shows the time curves adopted for the various switches. The distant 2,200-volt local distribution feeders (1), (see figure No. 2), were equipped with instantaneous excess current relays. The line switch (2) had to be set time selective with switches (1) up to any maximum short circuit current value which might be created by a short circuit beyond switches (1). It was calculated that such shorts would never exceed 45,000 kv.a., due to the limiting effect from the transformer reactance. Short circuits on the 50,000-volt side of this line, however, could exceed the value considerably. Switch (2) was, therefore, equipped with an inverse definite time relay having sufficient time lag up to shorts of 50,000 kv.a., to allow feeder switches (1) to clear ahead of the main line switch (2). In addition to this time limit protection, switch (2) was equipped with instantaneous relays of 50,000 kv.a., to effect a quick clearance of 50,000-volt line shorts. Thus time curve (2) was obtained for switch (2). Switch (3) in turn had to be time selective with switch (2). In this case the most critical point of the two time curves is the point where the instantaneous relay of switch (2) starts. Time curve for switch (3) had to be chosen so that at that point sufficient time difference existed to allow switch (2) to clear a trouble on its own line before the relays of switch (3) would close contacts. Switch (3) was also equipped with an instantaneous protection for heavy short circuits close to its station, similar to switch (2). The time curve for switches (4) was determined in a similar manner as stated for switch (3).

Finally, transformer switches (5) had to be made time selective with line switches (4). In this case, however, the time curve had to be made time selective with respect to the combination setting of the two lines (4) operated in parallel. Time curve for generator switch (6) was found to become so high that this protection was considered useless and was never installed.

The system of protection and settings, as shown in figure No. 3, was installed early in the spring of 1919. In addition to this time selective excess current protection, a double line protection and ground protection in conjunction with a ground selector were installed. These protective features are similar to those described in a previous paper published in April, 1921, issue of the *Engineering Journal.* These features are, therefore, not further discussed in this paper.

Operating Results of the Time Selective Excess Current Protection

The performance of the protection was carefully watched during the summer months of 1919. A considerable improvement could be noticed compared with previous conditions. It was, however, soon noticed that the protection was unable to function properly in case of distant line shorts. In several instances it happened that a trouble at the Thetford end which should have been cleared by switch (3), did clear very slowly or not at all and as result the short had to be cleared by the power house operator pulling line switches (4), thus causing a total interruption.

Upon closer investigation, it was noticed that this condition was particularly pronounced whenever one line only was in service between Shawinigan Falls and Victoriaville. Suspicion arose then that, apparently under the above operating condition, the sustained short circuit current dropped below the current settings of the relay, and that it was for this reason that the relay was unable to clear the short circuited line.

To verify this, a short circuit test was arranged, as per operating diagram, figure No. 5. Three generators with four step-up transformers were feeding over one

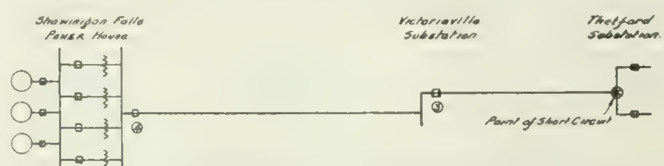


Fig 5. Operating Condition During Short Circuit Test which Proved the Inadequacy of the Excess Current Principle.

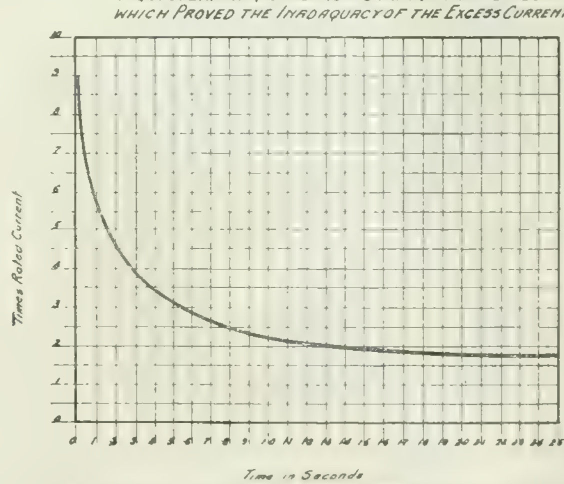


Fig 6 Typical Curve of Transient Short Circuit Current on 3 Phase Generator Subjected to 3 Phase Short Circuit

Figures Nos. 5 and 6.

line to Victoriaville into the Thetford line. A short circuit was thrown on to the system at Thetford and the relays of switch (3) were watched. The inverse definite time relay of the induction type started to move on the initial short circuit current kick, which indicated that the initial current rush was in excess of the current setting of 1.25 times normal load current. Before the relay disc reached the trip position, its movement became slower and slower and finally stopped completely. This was an indication that the short circuit current had dropped to the relay setting equal to 1.25 times normal load current. Finally, the relay disc started to move backwards, returning to its original dead position which

indicated that the final sustained short circuit current had dropped even below the tripping value of the relay; in fact from some other observations it could be noticed that the ultimate sustained short circuit had dropped even slightly below normal load current. All this happened within an interval of about two seconds.

The explanation of this apparently strange behaviour is to be sought partly in the high reactance of the lines and partly in the short circuit characteristics of generators in general. A dead short circuit at the terminals of a generator will cause a momentary current flow in the generator of up to 10 times normal load current or more. This short circuit current will, however, within one and one-half to two seconds, gradually drop to 1.5 to 2.5 times normal load current or less, depending on the characteristics of the generator. Figure No. 6 shows a typical curve of the gradual decrease of the short circuit current of a generator. This gradual decrease of the generator short circuit current from a high initial value to an ultimate low, or so-called sustained, value explains the behaviour of the relay in our short circuit test.

The test demonstrated clearly that the sustained short circuit current on the line under the given conditions dropped below normal load current. It was, therefore, clear that for such condition the principle of excess current protection was utterly inadequate, since no such excess current relay could naturally be given a setting low enough to be effective in case of shorts and still not operate under normal load conditions.

From the operating experience of the summer season, 1919, it had also been realized that it was very unsatisfactory to have a protection which would only offer a fair effectiveness under maximum generator and load condition, whereas under light load or abnormal operating conditions, the protection would be inoperative.

Figure No. 4 shows how particularly inadequate the excess current protection is with respective to light load conditions and with distant line short circuits. The sustained short circuit current values are shown for minimum condition of two generators and one line feeding to the extreme end of the system. The current values are the sustained values which would be created with short circuits at the extreme end of the respective lines. Comparing these values with the current settings of the respective line switches, it will be noticed that these values are all below the current setting of the respective line switches, with the exception of short circuit (2) cleared by switch (2).

From the foregoing it became evident that a new principle of protection had to be adopted before effective protection could be obtained for this system.

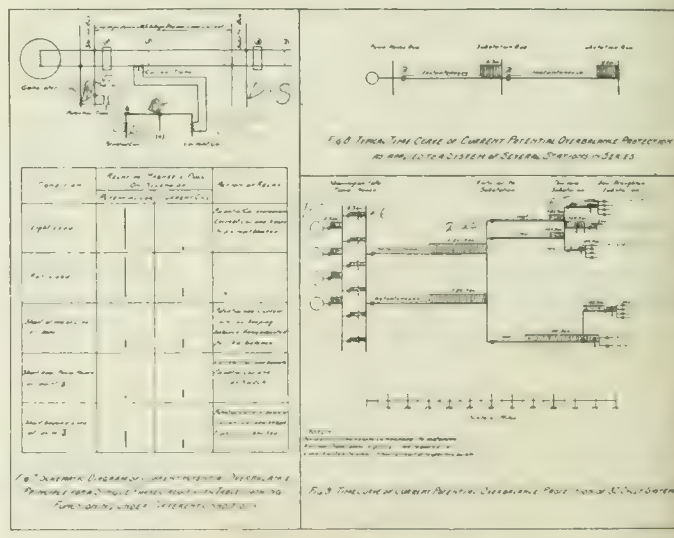
Current Potential Overbalance Protection

In the search for a new principle it was instantly realized that a new scheme had to take advantage of the fact that under short circuit conditions low voltage existed. Normal voltage had to keep the current relay blocked, even if its setting were below normal load current, so that it would not operate under any circumstances on normal load current, unless a short circuit existed at same time, pulling down the voltage.

An attempt was made first to develop a combination protection, consisting of current relays and low voltage relays. The complications and the difficulty of effective settings, however, were found to be so great that the idea was abandoned. After a few other fruitless attempts of alternate schemes, the principle of the so-called current potential overbalance protection was conceived of. A thorough preliminary study disclosed the soundness of the new principle and as a result it was decided to have the necessary relays developed and installed as a first trial installation on switches (3) and (4) of figure No. 2.

Theory of the New type of Protection

A transmission line of a certain physical characteristic represents a certain impedance "Z". If such line was short circuited at the far end and voltage was built up at the station bus from which the line emanates, the relation between current in the line and the bus voltage would be expressed by $E = I Z$. In other words, the current in the line is proportional to the bus voltage. Referring to figure No. 7, as an example, it is assumed that the impedance drop of the line is 10 per cent of normal voltage with normal line current flowing in the line; that means that the line, short circuited at its extreme end, would require 10 per cent of normal voltage at the station bus-bar to cause normal current to flow in the line. Any greater short circuit current under the same condition would leave a proportionally higher voltage at the station bus-bar.



Figures Nos. 7, 8 and 9.

In case of a line short circuit closer to the station the impedance of the circuit to the short circuit point would become lower and as a result less voltage would be left at the bus-bar, with the same current flowing in the line, compared with a far end short. On the other hand, a short circuit beyond the next substation would offer a higher impedance and in consequence would leave higher voltage for the same current flowing in the line.

A relay (see figure No. 7) consisting of a beam pivoted in the centre, and equipped at either end with a solenoid, one side being equipped with a current coil fed from the line and the other side having a potential coil fed from the station bus, could be adjusted with respect to current and potential coils in such a fashion that the magnetic pull of current and potential coil

would just be equal under condition of a short circuit at the extreme end of the line. A trip circuit arranged as shown would trip the line switch whenever the current coil would overpower the potential coil.

In our specific case of figure No. 7, the two coils could be adjusted for a balance of 10% voltage against normal current. Such balanced condition would exist irrespective of the actual short circuit current as long as the short circuit would be at the same point, since any change in the current coil would also produce a proportional change in the potential coil. A short circuit closer to the station, however, would leave a lower voltage on the potential coil of the relay, because of the lower impedance and as a result would cause the current coil to overpower the potential coil and would thus trip the line switch. A short circuit beyond the end of the line would leave more than 10% voltage per normal current, because of the higher impedance and, in consequence, the potential coil would overpower the current coil and would thus keep the trip circuit blocked. Under normal load condition, the potential coil, with full voltage across, will keep the current coil overpowered and will thus keep the trip circuit blocked. The relation of the magnetic pull on the solenoids under different conditions is more clearly understood from the table accompanying figure No. 7.

Principal Features of the New Protection

From the foregoing it will be seen that the new type of protection has the following valuable features, none of which can be attained by the excess current principle of protection:—

1. Its actuation depends entirely on the relation between current and voltage irrespective of their actual magnitude.
2. The protection will be just as effective, therefore, for currents below normal load current; and in consequence the functioning can be made the same for all operating conditions and irrespective of the generator capacity.
3. The actuation of the relay depends on the location of the short circuit, so that its radius of action can be fixed. In consequence, selective action of switches in series can be obtained by limiting the active radius of the relay, instead of by time selective setting. Thus, it is possible to greatly reduce the time settings of relay protection toward the power house.
4. The protection is unaffected by load conditions and thus does not cause wrong tripping of lines due to unexpected load increases.

In the example of figure No. 7, it was assumed that the relay would be adjusted for such balance that it would just cover the short circuit condition of the line end short. In actual practice, no such accurate adjustment would be possible. In order to be sure that the protection of switch (A), figure No. 7, will be effective for shorts at the end of the line and for troubles in the substation, it will be necessary to set the relay balance of potential and current somewhat higher than the impedance would require, say 12% voltage per normal load current, instead of 10% voltage per normal load current, as was assumed in our example, figure No. 7. Thus, in case a substation bus short creating on the relay 10% voltage per normal load current only, the current coil will have a decided overpowering effect and will thus assure effective tripping. As a result of this higher balance adjustment in the relay of switch (A), its radius of action will extend into the line controlled by switch (B). A short circuit at point (3) in that line would, therefore, be liable to trip switch (A) as well as switch (B), if both were instantaneous. In order to prevent a wrong tripping of switch (A) under these conditions, switch (A) protection would have to be provided with a time lag sufficient to allow switch (B) to clear ahead of switch (A).

In actual practice, the selectiveness between the switches in series was solved by providing each switch with two sets of protection. One set, adjusted for a balance to be effective for line end shorts and substation shorts. This set is provided with a time delay sufficient to allow switch (B) to clear on instantaneous protection. The other set of protection is adjusted for a balance which will confine its active range to its own line. This set can be made instantaneous since its balance adjustment prevents it from operating in case of a short circuit beyond switch (B), so that no time selective adjustment will be required for this set.

The functioning and radius of action of a protection as above described for a system of two lines in series is illustrated in figure No. 8. Distant line shorts on line (A), as well as line (B), are cleared by their respective switches by time limit relays. Short circuits at the beginning of the respective lines are cleared by instantaneous relays. From this example, it will be noticed that the great advantage of the new scheme is that no progressive time setting towards the power house is required, such as is necessary with the excess current principle of protection; but that instantaneous protection can be introduced by applying relays of such a potential current balance setting that their range of action does not overlap the switch ahead.

Current Potential Overbalance Protection for 30-Cycle System

In the Spring of 1920, the first lines were equipped with this new type of protection. The protection was tested out with actual extreme conditions and the result proved fully satisfactory. It was, therefore, decided to equip the whole system with this new type of protection. The 50,000-volt line system is completed and in service since the Fall of 1921, and the power house protection is in the course of completion. Figure No. 9 shows a diagram of the system, indicating in what time short circuits at various points of the system are cleared. From this diagram it will be noticed that the action of the relay depends entirely on the location of the short circuit, the protection being equally effective for minimum as well as maximum generator capacity. The diagram shows how distant line shorts only are cleared by time protection whereas shorts nearer the substations are all cleared instantaneously. The diagram shows also how the new protection permits a very effective power house protection back to the generators, which is in great contrast to the results with the excess current principle (see figure No. 3).

Testing and Operating Results of the New Protection

In the Fall of 1921, after completion of the line protection a series of tests were made to find out any

possible weak feature of the new protection; but the tests proved that the protection was fully effective for all conceivable conditions.

The protection has effectively operated ever since its installation. The outstanding features with respect to the operating results are:—

(a) Since the installation of the new protection there has been no case where the operator had to clear a short circuited line by hand; which latter condition was quite a common occurrence on the previous excess current protection.

(b) There is nothing to indicate that the new principle might cause incorrect actions.

(c) The one inconvenient feature of the protection wherever the protection has to be effective even for currents below normal load current, is the danger that the relay is liable to trip a line on normal load current, should ever the potential circuit be ruptured accidentally. During the two years of service there are two such caset recorded. Both these cases were caused by an open circuit developing in the tap block of relays. Some alteration in the design, however, has eliminated any such recurrence. Other causes of open circuiting the potential circuits are very remote as long as the wiring layout is carefully worked out and as long as the operating staff is properly instructed.

Type of Relay Employed

As pointed out above, the principle of protection is based on an over-powering effect of current against voltage, irrespective of phase angle relation. Any relay principle could be employed therefore, in which current and potential produce mechanical forces, which are proportional to the actual value of current and voltage respectively. The two mechanical forces thus created must cause opposing movements on a mechanical structure so that the actual movement takes place in the direction of the greater force.

The induction principle similar to the induction type excess current relay could be used, having current and potential creating opposing torques on the shaft. Similarly the dynamometer principle could be used to produce opposing torques on a shaft.

In our case it was felt that a simpler and more rugged relay was obtained by using a beam pivoted in the centre and with current and potential solenoid mounted on opposite ends of the beam. Thus the beam is pulled to the side of excess force. All relays were developed along this line. Current and potential coils were provided with taps, so that different adjustments can be obtained. In this way, any desired balance can be established by choosing such taps on the two coils that for a given current and potential value, for which balance is to be created, the ampere turns and thus the magnetic force of the two coils become the same.

General Application of the New Protective Principle

The question may arise whether the system for which the protection was developed was particularly different from others, so that the general application may be limited. In this respect it may be said that very similar conditions exist on all systems, where the total power house capacity is fed over a few large capacity trunk lines. In any such case the sustained short circuit current for distant shorts will always drop near or below the maximum normal load current, so that any excess current relay, set at 150 per cent of normal load current, will become useless. This condition is still more pronounced on modern systems, where the tendency is to install high reactance generators which have a sustained short circuit current of normal load current or less.

The new principle, therefore, represents a much needed, forward step in the art of relay protection which will help to make long distance transmission safer and more effective.

In closing the author wishes to express his appreciation to the Shawinigan Water and Power Company, for its broad-minded policy in supporting and encouraging development work of this nature.

Mention also must be made of the valuable and untiring assistance given by C. E. Cansfield and W. G. Mayhew in the working out of the practical details of the relays, which was just as essential for the final success of the new protection as the correctness of the principle.

Some Points of Contact Between Metallurgy and Engineering

Recent advances towards the Use of Light Alloys in Structural Engineering Practice

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Prior to the eighteenth century there existed but few points of contact between the metallurgist and the engineer. The former was mainly engaged in the production of materials for use in the manufacture of domestic appliances such as, stove plates, kettles, cauldrons and smaller household apparatus, agricultural implements and instruments of war. As early as 1414 we find record of the founding of guns in cast iron, while in 1516 no less an achievement than the casting of a five-ton cannon is recorded as having taken place in London, England. Pliny, however, records the use of lead in the manufacture of conduit pipes and that lead sheet was used for the protection of roofs of buildings very early in man's history is quite generally known. The municipal engineer and the architect have continued to make contact with the metallurgist until this day.

Early Development of Iron and Steel Industry

The most important events in the history of this useful alliance of professions may well be recorded here. In France so early as 1664 the iron industry was in such a state of perfection as to be in a position to supply at Versailles a line of cast-iron pipe of which in 1917 some five miles were still in use, while in the United States in 1798 the same industry was in a position to supply the Aaron Burr Water Company with sections for the erection of a cast-iron reservoir in New York, the metal of which sections, when the reservoir was recently dismantled, was as good as it was a century or so ago. About this time — the "eighties of the eighteenth century" — another point of contact was made between the two professions. In 1788 Abraham Darby, the master of the Colebrook Dale Iron Works and the eldest son of the Abraham Darby who first successfully employed coke in the manufacture of iron in the blast furnace, was awarded by the Society of Arts a gold medal for what was the first complete bridge of metal — a structure of cast iron which to-day still spans the Severn, one hundred and thirty-four years or more since it was erected.

Prior to 1728 such malleable iron as was then produced was formed into plate, sheet and rod by the slow and laborious process of hammering. In 1728, however, John Payne constructed a sheet mill, in which rolls were employed for the reduction of the metal and the use of which resulted in a marked increase in the output of products of the type upon which the civil engineer is largely dependent for the success of his work at the present time. Without John Payne's invention the steam engine could scarcely have developed as it did in the hands of Watt and his contemporaries at the middle of the eighteenth century. A yet more important achievement in metallurgical practice transpired in the "eighties" of the eighteenth century. Within the space of two years Henry Cort, the owner of an ironworks at Fontley, Hampshire, patented both the process of puddling iron, that is used with certain important modifications to this day, and the employment of grooved rolls for the production of rods and bars. These two processes were so successfully worked and developed under royalty by iron-masters throughout England that by 1791 the annual output of puddled and rolled iron had reached the then amazing figure of fifty thousand tons per annum. Henry Cort has rightly been named "the father of the iron industry." Following swiftly and made possible by this marked advance in metallurgical practice came the locomotive. By 1825 both the first permanent way for locomotive traffic and the first railway bridge had been constructed.

The next few years witnessed a network of railways spreading throughout the length and breadth of Great Britain, but in this connection no scientific advance of marked importance prior to that made by Robert Stephenson in 1847 has been recorded. At this time the construction of the Conway and the Britannia bridges being under contemplation, Stephenson delegated to Fairbairn and Hodgkinson the work of comparing the mechanical properties of cast and of wrought iron. As a result of the experiments conducted by these two investigators the superiority of the latter product was demonstrated and its use in the construction of his two bridges was decided upon by Stephenson. It was probably as a result of these trials that within two decades cast iron had entirely passed out of use as material for the construction of the main members of railroad bridges, and that until about 1880 wrought iron held the field as the most reliable material of construction.

In 1856 came the Bessemer process of steel manufacture, and later, in 1864, the Siemens furnace, wherein the Martin process of steel production was successfully conducted. The application of electricity by Sir Wm. Siemens in this connection was first dealt with in 1879; it was not until 1898, however, that the electric furnace was used economically, the first electric furnace so to be employed being that of Stassano, a major of the Italian army. Bessemer steel never proved to be very popular with bridge engineers, though the Forth bridge was built of steel made by this process. However with the product of the open-hearth furnace at hand for comparison with wrought iron it was not surprising that the next generation of engineers abandoned the latter material in favour of the former. Hence it was that by 1890 wrought iron had been almost entirely supplanted by open hearth steel in constructional work.

Research on Alloys

The results of researches such as those of Hadfield on manganese-steel published in 1888, and those of Riley on nickel-steel, published in 1889, opened up an avenue upon which such advance has been made by the metallurgist as has given to the engineer those steels upon which, for one example, the future development of long span bridge construction appears to be largely dependent.

It is still less than one hundred years since Wöhler obtained relatively pure aluminium by the device of heating aluminium chloride with potassium. It was not until 1854 that any appreciable reduction in the cost of manufacturing aluminium occurred. About this time, however, the classical work of St. Claire Deville, had enabled the price of this metal to be reduced from about \$110 to about \$6.50 a pound, and by 1892 the development of electrolytic processes for the extraction of aluminium from its oxide had led to a still further reduction in its price — the Héroult-Hall process has made such strides that there was a good supply of pure metal at \$1.70 per pound. At the present time 98 to 99 per cent aluminium may be purchased for about twenty cents a pound. As would be expected, the alloys of this new metal have been the subject of considerable investigation. The ninth report of the Alloys Research Committee to the Institute of Mechanical Engineers, which was presented on January 21st, 1910, may be considered as a milestone on the way of discovery in this connection, since it was to such alloys as were dealt with in this report that Wilm, in 1911, added the element magnesium with the result that light alloys were discovered having the property of hardening with lapse of time subsequent to their quenching — a characteristic analogous to that possessed by steel.

Economics of Alloys of Aluminium for Structural Work

Now it appears to the speaker that it might be of interest to the members of *The Institute* to enquire into

the economics of certain of the light alloys of aluminium in respect of their use in structural work. These alloys hitherto have been almost entirely employed by the mechanical engineer. They have, on account of those properties later to be considered, proved of special service in the construction of aircraft; but few structures wherein these alloys have played a part have been erected. The reason for this will not be far from sight when the subject has been more fully investigated. However, let it be said at once that the item of cost per unit weight of metallic aluminium alone appears to the speaker to stand between these alloys and the possibility of their more general adoption by structural engineers. Whether it will prove economical to employ the light alloys in the construction of, buildings or bridges, will depend upon three things, — the cost per unit weight of the alloy employed; its yield point; and its specific gravity. It is obvious that the total cost of any given structure will vary, directly as the cost per unit weight of the material forming the structure; inversely as the yield point of the material forming the structure, since, other things being equal, the weight of material required will be less the higher its yield point; and directly as the density of the material forming the structure, since the dead load varies directly as the density of the material forming the structure.

If then, C be the total cost of a given structure, c the cost per unit weight of the material forming the structure, Y its yield point and P its density, then C varies directly as cP/Y. For convenience, Y/P may, be termed the specific yield point, and may, for like reasons, be given the symbol s; hence C varies directly as c/s.

If now a given light alloy is to compete successfully with steel, the ratio of its cost per unit weight, c, to its specific yield point, s, i.e. its ratio c/s, must, other things being equal, be less than the ratio c/s for steel. If for structural steel at the source of supply we assume the cost to be two cents a pound, the yield point to be 32,000 pounds per square inch and the specific gravity to be 7.85, we have for c the value 2, for s the value 4,076, and for the c/s ratio the value 0.00049. If then a given light alloy is to compete successfully with steel its c/s ratio must be equal to or less than 0.00049.

Composition and Mechanical Properties of Duralumin

Let us now consider how duralumin, the light alloy discovered by Wilm in 1911 which has been referred to above, stands in this respect. Leaving for the moment the question of its cost per unit weight let us turn our attention to its composition and to its mechanical properties. Those complex light alloys classified under the name duralumin contain from 3.5 per cent to 4 per cent of copper, from 0.5 per cent to 1 per cent of manganese and up to 0.5 per cent of magnesium. There are generally present in these alloys small proportions of silicon, an element which has been shown by Rosenhain and his collaborators to exert a most important influence upon certain of the peculiar properties of these alloys.

In the cast state these alloys offer little to surprise, in so far as their mechanical properties are concerned. The average tensile strength of the same, as cast in sand, is but 15,600 pounds per square inch, that of the alloy, as cast in chill, is 14,200 pounds per square inch — the ductility and the resistance offered to shock by these alloys is practically nil. Thermal treatment of these cast alloys, while it does result in an improvement in their tenacity, has not the least influence upon their ductility and resistance to shock. The reduction of these alloys in the rolls or by drawing can be successfully accomplished at temperatures in the vicinity of 450°C. If, however, these alloys be annealed at 450°C., subsequent to casting they can be reduced in the rolls at ordinary temperatures without appreciable difficulty. For sheets of thickness in excess of about one-half inch the maximum percentage reduction in thickness of strip that can be thus effected without rupture of the sheets is about 33⅓ per cent. The mechanical properties of duralumin sheet such as has first been rolled at room temperature, has then been annealed at 450°C., and has finally been cooled in air, are about as follows:—

	Yield point lbs. sq. inch	Maximum stress lbs. sq. inch	Elongation per cent. (1 = plus or minus 8 \ a)
Longitudinal............	18,500	46,000	18
Transverse.............	17,100	37.000	10

Here then, is a material possessed of the tenacity of a normalized mild steel containing about 0.085 per cent of carbon and but little manganese. Its ductility is, however, low in comparison to that of such steel. If such rolled sheet as is referred to above be heated to a temperature of 475°C., and quenched in water at 20°C., it is found to have undergone a profound change in constitution. Tests made on the material immediately after quenching show it to be possessed of the following mechanical properties:—

Yield point lbs. sq. inch	Maximum stress lbs. sq. inch	Elongation per cent.
14,200	42,700	20

Apart from the fact that the values for the elastic limit and the maximum stress of the alloy are somewhat less and those for the other constant are somewhat greater, no appreciable change can be said to have occurred in the same. With lapse of time, however, a continuous and radical change occurs in the alloy which results in a remarkable rise in its tenacity. Tests made on the last alloy, four days subsequent to its quenching, showed it to have the following characteristics:—

Yield point lbs. sq. inch	Maximum stress lbs. sq. inch	Elongation per cent.
31,300	54,100	22

The material is now possessed of the yield point and of the tenacity of a 0.14 carbon steel (annealed at 866°C., the annealing temperature recommended for this steel by the American Society for Testing Materials) and a percentage elongation considerably less than that of the same steel (39.5 per cent on two inches).

Tests on a Duralumin Channel

In this connection may well be recorded the results of tests quoted by Rosenhain, Archbutt and Hanson in the last report of the Alloys Research Committee to the Institute of Mechanical Engineers. Tests were made in 1911 on a duralumin channel with the following results:

Yield point lbs. sq. inch.	Maximum stress lbs. sq. inch	Elongation per cent. on 3 inches
37,900	59,400	16.6
39,200	61,600	20.3

From the same channel, samples were removed for tests in 1921, the results of which were as follows:

Yield point lbs sq inch	Maximum stress lbs sq inch	Elongation per cent on 3 inches
46,100	64,300	15.3
46,400	62,000	14.7

Here is material possessed of such tenacity as would make it quite acceptable for service under the structural steel specification of the Canadian Engineering Standards Association. Its ductility, however, is such as to make it doubtful whether it could be successfully employed in place of structural steel in this connection.

Determination of the c/s Ratio of Duralumin

The c/s ratio for this material may now be determined. At the present time duralumin sheet costs about 30 per cent more than does aluminium sheet, ranging from forty to forty-five cents per pound, while duralumin rod may be purchased at about the price of pure metal rod, thirty cents per pound. The yield point of duralumin may, we think, quite justly be taken as 40,000 pounds per square inch. Its specific gravity is in the neighbourhood of 2.8. Its specific yield point is, therefore, 40,000/2.8 or 14,300 and the c/s ratio, assuming a price of 35 cents per pound will be 35/14,300 or 0.00245. The c/s ratio for duralumin is, therefore, about five times that of our standard steel. Let it here be noted that the scales have been slightly weighted in favour of the steel. It is a matter of fact that under the Canadian Engineering Standards Association specification for structural steel material possessed of a yield point of as little as 27,500 pounds per square inch could pass for service, that is, material such as would have a specific yield point of 3,503 and a c/s ratio of 0.00057, and from what we have seen an elastic limit of at least 45,000 pounds per square inch may sometimes be expected of duralumin. The c/s ratio of such material would be as low as 0.00218; about 3.82 times that of the steel.

Important Alloys Recently Investigated

Of the light alloys recently investigated those referred to in the eleventh report of the Alloys Research Committee to the Institute of Mechanical Engineers as alloys A, E, F, G and Y, are of particular importance. The first of these alloys — alloy A — contained, apart from aluminium, 20 per cent of zinc and 3 per cent of copper. It was possessed of a specific gravity of 3.1. After much experiment it was successfully reduced by hot rolling to rod 1⅝ inch in diameter and less. The results of tensile tests upon this alloy in the form of rod are recorded below:—

Diameter of rod (hot rolled) inches	Elastic limit lbs. sq. inch	Yield point lbs. sq. inch	Maximum stress lbs. sq. inch	Elongation per cent. on 2 inches
1⅝	26,400-29,100	39,400	59,100	17
1¼	-	41,400	61,400	18
⅞	-	41,000	60,500	21
½	-	39,000	59,800	(on 1″) 30

The safe range of alternating stress, (Wöhler test), for this alloy at 20°C is plus or minus 19,500 pounds per square inch. This alloy is possessed of a tensile strength in the hot-rolled state equal to that of a 0.18 carbon steel annealed at 858°C., the annealing temperature recommended for this steel by the American Society for Testing Materials. It is a somewhat cheaper alloy than duralumin and should cost about twenty-eight cents per pound. Assuming the material to have a specific yield point of 39,000 pounds per square inch, its c/s ratio would be 0.00222; about 4.5 times that of our standard steel.

The second of these alloys — alloy E — contained, apart from aluminium, 20 per cent of zinc, 2.5 per cent of copper, 0.5 per cent each of magnesium and of manganese and proportions of iron and silicon not exceeding 0.2 per cent. Tabulated below are the results of tensile tests on this material in the hot-rolled state, and quenched from 400°C., and aged for five days.

Diameter of rod inch	Yield point lbs sq inch	Maximum stress lbs sq inch	Elongation per cent on 2 inches
⅞	53,100	66,500	15
⅞	48,400	91,200	9

In this case the safe range of alternating stress is plus or minus 21,700 pounds per square inch. This alloy is possessed of a mean c/s ratio of about 0.00174, a ratio which is about 3.6 times that of our standard steel.

The third and fourth of these complex alloys — alloys F and G — were of the following analyses:— F, copper 2.5; zinc, 20.0; magnesium 0.5; manganese 0.5; silicon 0.75, and the remainder aluminium. G, copper 2.5; zinc, 18.0; magnesium 0.35; manganese 0.35; silicon 0.80 and the remainder aluminium.

The results of tests made on the alloy F, are recorded below: —

Condition	Yield point lbs. sq. inch	Maximum stress lbs. sq. inch	Elongation per cent on 2 inches
⅞ inch hot rolled rod, quenched from 400°C. and aged for 5 days.	56,700	80,600	16
0.04-0.05 inch sheet similarly treated.	68,100	79,300	19

For this alloy in the first condition the c/s ratio is as low as 0.00153, for the same in the second state the ratio is as low as 0.00127. The ratio is in the first instance about 3.13 times and in the second case about 2.59 times that of our standard steel. The mechanical properties of alloy G, quenched from 400°C and aged, are as follows:—yield point 68,500 pounds per square inch; maximum stress 77,500 pounds per square inch; elongation 19 per cent. In this case the alloy was tested in the form of sheet 0.04 to 0.05 inch in thickness which had been quenched and aged. The c/s ratio for this alloy is 0.00127, practically the same as the last, and is about 2.59 times that of our standard steel.

The mechanical properties of the last alloy we shall consider in this connection — alloy Y — have been referred to by Rosenhain, Archbutt and Hanson in the following terms, — "The material shows an ultimate stress of 26 to 27 tons per square inch (long tons of 2,240 pounds) with 16 to 18 per cent extension on two inches in the case of sheet 0.5 inch thick; thinner sheet, 0.18 inch thick, shows tensile strength of 27 to 28 tons per square inch with elongation of 15 to 17 per cent on two inches." Experiments by these observers on samples of this alloy prepared by cold rolling at the Royal Aircraft Establishment and quenched subsequent to deformation from a temperature of 520°C., showed the treated alloy to be possessed of the following mechanical

properties: — yield point 47,000 pounds per square inch; maximum stress 62,700 pounds per square inch; elongation 18 per cent on 2 inches.

Both the cost per unit weight and the density of this alloy approach closely to those of duralumin. Assuming 47,000 pounds per square inch to be the yield point, 2.8 to be the specific gravity and thirty-five cents per pound to be the cost per unit weight of the Y alloy we obtain as the c/s ratio the value 0.00201 — 4.10 times that of our standard steel.

Possibility of use of Light Alloys in the Structural Field

Now it will be noted that the yield points of all the alloys we have considered are such as would allow of their acceptance for service under the Canadian Engineering Standards Association specification for steel for bridge construction, and that their tenacities are such as would permit of similar treatment, but that their ductilities are in most cases somewhat less than those accustomed to the use of structural steel would feel justified in allowing to pass unnoticed. To this aspect of the situation we will refer later. For the present it may be emphasized that, but for the high cost of these alloys, their immediate use might be expedient in certain instances. The cost factor is that which in the c/s ratio weighs so heavily against these light materials. We have dealt in terms of the delivery costs of these light alloys, and of steel, not in terms of the cost of these same materials in place in the finished structures. When consideration is taken, of the lower cost of transportation, and note is made of the lighter machinery that would be required to cope with the problem of erection, and when it is considered that a brisk demand for these materials might result in a material reduction in their price — it might have an exactly opposite effect at first — and, lastly, when it is remembered that both the methods of manufacture of these alloys and the alloys themselves are subject to improvement, there is good reason for the opinion that their use in construction is not likely long to be delayed.

Reverting to the question of the ductility of these alloys, it should be remembered that, while a given minimum value for the percentage elongation of steel may serve as a criterion of the toughness of that product, it does not of necessity mean that a similar value for this factor in the case of another alloy will serve the same purpose in identically the same way. It has been clearly demonstrated that while notch toughness may serve to distinguish between the good and the bad of a given batch of material of about the same composition, it cannot be relied upon to determine the relative merits of material of totally different character and composition. The same argument may be applied in some measure to the question of ductility. However, a point in this connection, worthy of note, is that the safe range of stress reversal for these alloys is only about half that of structural steel.

In table No. 1, are collected the results of the determination of the c/s ratio for these light alloys, together with the ratio of the c/s values of these light alloys to those of steel and their approximate price per pound.

TABLE No. 1

Material	c/s	Ratio of c/s value of alloy to c/s value of steel	Approximate price per pound	Reduced price per pound (approx.) to compete with steel.
			cents	cents
Steel (lbs. sq. inch) (32,000 yield point)	0.00049	1	2	2
Duralumin	0.00245	5.0	35	7
Alloy A	0.00222	4.5	28	6
Alloy E	0.00174	3.6	28	8
Alloy F (a)	0.00153	3.1	28	9
(b)	0.00127	2.6	28	11
Alloy G	0.00127	2.6	28	11
Alloy Y	0.00201	4.1	35	8

A brief consideration of the results contained in this table will serve to show that, if these alloys are to compete successfully with steel, they must be reduced in price to the values quoted in the last column. Here again let it be observed that in arriving at these values it has been assumed that the cost per unit weight of these materials in place within a given structure is a constant multiple of the cost per unit weight of the materials at their place of origin. In order to make plain the difference in the cost of erection that is likely to ensue as a result of the employment of these light alloys it is only necessary that attention be directed to table No. II.

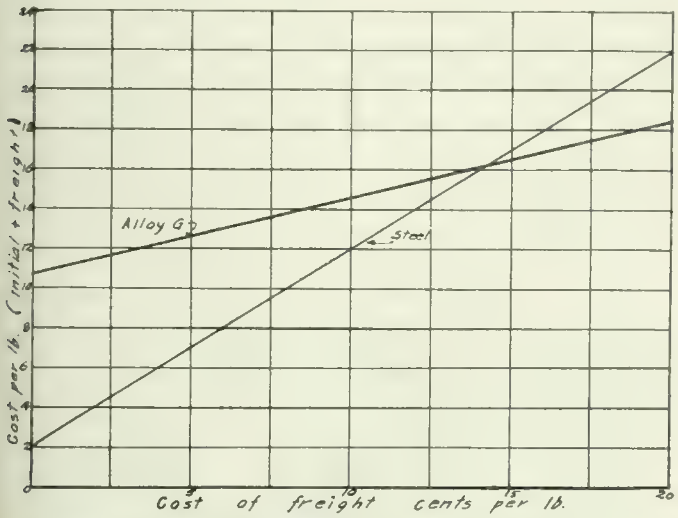
TABLE No. II

Dimensions of I-beam section		Approximate weights per foot in pounds.	
D inches	B inches	Steel	Light Alloy
3	1½	4	1½
6	3	12	4½
9	4	21	8
12	5	30	11¼
15	6	45	17
18	6	55	20½
24	7½	90	33¾

A moment's thought will make it obvious that in the erection of certain structures the use of steam or electric driven lifting machinery could be entirely eliminated were the light alloys employed in place of steel, not that this of necessity means a lessening of the total cost of erection. Nevertheless, it is possible that the freight charges coincident with the transportation of lifting machinery could in such extreme cases thus be entirely eliminated. In any case, such mechanical devices as are required in the erection of steel structures could be replaced by others of much lighter type were the light alloys employed.

Yet another point worthy of consideration here is the cost of shopwork that is likely to ensue in connection with structures made of these light alloys. The specific yield points of the light alloys are considerably in excess of those ever likely to be obtained in such alloy steels as could economically be employed in construction. Consider, for example, the nickel-steel occasionally employed in bridge construction. This has a yield point of about 60,000 pounds per square inch, hence a specific

yield point of about 66,000/7.7 or 7,800, almost half that of duralumin, the light alloy of those we have considered possessed of the least value for this factor. The machineability of nickel-steel, however, is considerably less than is that of the light alloys, which are relatively easy to ream or drill. Hence, those extra expenses attached to the use of the special steels on account of the concurrent increase in their resistance to penetration and their tenacity, are not likely to be experienced when the light alloys are in employment.



Approximate effect of freight charges on choice between steel and light alloy G.

With the view of indicating the approximate manner in which the cost of freight is likely to effect the question of choice between steel and the light alloy G, the writer has prepared the above graph. The values plotted therein have been arrived at in a manner similar to that in which the values given in table No. 2 of the paper have been obtained; the ratio of the cost per pound plus the freight charge per pound, to the values 2.6 for alloy G, (see table No. 1, column 2), and 1, for steel, have been plotted. As a result it is demonstrated that the freight charge would have to attain the figure of fourteen cents per pound before alloy G could compete with steel. It is here assumed that other costs, shop costs and erection costs — are unchanged. This, as has been shown, is not likely to be the case.

Finally, the costs of freight and of transportation of the structural material itself, especially in a country of vast distances such as is Canada, are of immense importance. To the cost of structural materials per unit weight at their place of origin there may be added, under certain circumstances, freight charges of as much as five cents per pound. Such freight charges may sometimes become disproportionate, even prohibitive, items of expense. If, therefore, these charges could, by the use of light alloys, be reduced to practically a third (to something at any rate greater than 2.95/7.85 or 1/2.66) of their amount, the use of such alloys might be abundantly justified in certain situations. In outposts of the Dominion where the erection of buildings and of other structures, which now would be made of steel, this is essential for the successful issue of all manner of engineering enterprise. The possibility of the elimination of freight charges on plant required for erection has been referred to already.

It might well be that in certain circumstances these three items of expense — erection costs, shop costs and freight costs — might sufficiently reduce the total cost of erecting a structure in a light alloy, even at present prices, to enable its use in place of steel to be seriously considered.

The question of corrosion in this connection is a vital one, although no more vital than is that of the corrosion of steel. .The protection of aluminium can be accomplished as can that of its alloys. The use of these alloys in situations where they are likely to be brought into contact with sea water could not, it is thought, be considered at present. Much more work requires to be done before a definite statement as to the reliability of protected light alloy structures under these conditions could be made. In the construction of buildings where protection from wind and weather is afforded, the use of these alloys could certainly be recommended, and there does not seem to be any reason why their use in the open, suitably protected, should not be considered. The opinions of Dr. Rosenhain, who has been as closely associated with the advancement of these alloys as any man, may be quoted here and with his words we may well close this discussion of what the speaker feels is likely to be, in the not distant future, a further point of contact between the metallurgist and the engineer. "In the largest bridges and roofs, it is well known that the greater part of the load which the structure has to bear consists of its own weight, the so-called live load or useful load, such as a railway train, representing only a small fraction of the weight of the structure itself. Actually, the longest possible span which can be constructed is limited by this consideration of the weight of the structure itself and the stresses which it imposes upon its members. The use of a material of very much lower density and of equal strength with mild steel, therefore, suggests the possibility of very greatly increasing the maximum possible span. There are, of course, not many situations in which these very huge spans would be required, but apart from that particular point, it must be borne in mind that the cost of a structure of large span is largely due to the fact that metal has to be provided mainly to bear the weight of the structure itself. It would certainly be possible to reduce this weight to a very considerable extent by replacing steel by aluminum alloys for those parts of the structure, at all events, which are responsible for the greatest development of stress in the remaining members. As an example of what is meant, the central portion of a cantilever bridge may be cited. This is really a small independent girder connection the ends of the great cantilevers, and it is the weight of this central portion of the span which, to a large extent, governs the size and cost of the cantilevers themselves. By replacing this central span by a structure of aluminum alloy, a very large saving in the weight and cost of the steel constituting the rest of the structure could be effected, and it is, at all events, worth suggesting to bridge designers that the calculation of the relative cost of two structures, one made entirely of steel, and the other in which the central portion was made of a light alloy, is worth considering. Similar considerations also apply to roofs and other structures having exceptionally large span, where the weight of the structure itself enters largely into the cost of the material employed in building it. In the case of roofs, particularly, where the structure is protected from the action of the weather, the question of corrodibility does not enter seriously into the case. In any structure, however, the application of suitable protective coatings could be no more difficult in aluminum alloys than in the case of steel, and in the absence, at all events, of sea water, or spray derived from the sea, the relative permanence of an aluminum alloy structure and a steel structure, both properly protected, would not be very different."

Paint as a Protection for Steel Structures

Fundamental Requirements in use of Paint for the Protection of Steel.

John Grieve, A.M.E.I.C.,
General Manager of Sales, Dominion Paint Works Limited.

Paper read before the Montreal Branch, The Engineering Institute of Canada, October 26th, 1922.

Steel is the backbone of all structural design. The base on which engineering stands, in its relation to industrial development as an indispensable profession, is the manipulation of steel to its various uses. Every such development is dependent for success upon the service of the materials used in the design, their efficient distribution and the low maintenance costs due either to operation or depreciation. The importance of arresting corrosion is admitted by engineers as it is known that steel will decay, if natural agencies are allowed to act on it, more rapidly than any other material used in construction.

The transactions of almost every engineering society include papers on this subject — all kinds of theories have been advanced and suggestions submitted, but the subject has not yet attained the attention which its importance demands.

Facts Which Have Militated Against Proper Consideration of Corrosion

(*A*) *Compartively recent acceptance of electro-chemical explanation.*

Practically the whole development of steel construction has occurred during the past fifty years, while the electro-chemical explanation of corrosion has been advanced, made the basis of tests and been generally accepted only within the past twenty years. It is evident therefore that for about thirty years the whole subject of corrosion was indefinite in the minds of many and few sound methods were advanced to combat it.

When one considers that practical exposure tests of selected paints require from three to four years for preliminary investigations before the qualities of each film can be determined, and thereafter from six to ten years to obtain the comparative results for service efficiency of the combined films, one can readily appreciate that only within the past decade have the anti-corrosive merits of some paint ingredients been truly appreciated.

(*B*) *Lapse of time necessary to judge value of service tests.*

It is necessary in the manufacture of paints to test chemically, pigments, gums and oils used, prior to their incorporation in the paint, to insure freedom from undesirable impurities. In the physical laboratory also, many preliminary tests can be made to ascertain if a film has the desired qualities, but just as accelerated physical laboratory tests do not indicate the action which takes place gradually over an extended period between pigments and vehicle under exposure, so chemical analysis, after the paint is manufactured, does not indicate — except perhaps in elementary paints — the quality of ingredients, skill of compounding or service value of the paint.

Authorities have recognized for a long time that by ageing, in some cases for several years, oils, varnishes and mixture of these with pigments, very much enhanced service value is obtained for the product. Chemical laboratory analysis, even in conjunction with accelerated physical tests, does not indicate or take into consideration this ageing of materials. Therefore, between paints of similar analysis there is no assurance of equal service value. The only true tests are those where paints are subjected to service exposure tests under conditions to which the paint will be subjected. These necessarily involve time.

The importance of actual exposure tests and the doubtful value of accelerated laboratory tests is mentioned by all authorities who have had an opportunity to compare results. A. S. Cushman and H. A. Gardiner in their study of "Corrosion and Preservation of Iron and Steel", emphasize this point as follows: — "The results of the acceleration tests may be taken as fairly good evidence of how the paint will work in practice but a series of practical exposure tests should also be started so that definite knowledge can be obtained in regard to their protective value". Again, they state that, "Owing to the nature of corrosion it is probably true that no perfectly reliable acceleration test for corrosion resistance can be devised. Corrosion is the natural process of rust formation, that is to say, in very slightly acid media, it is a question of comparatively slow growth under special conditions, and any effort to hasten the action changes all the conditions of equilibrium, producing an entirely different order of phenomena".

The opinion that the physical state of the paint after it is manufactured is a more vital factor than the composition of the paint and the importance of exposure tests to demonstrate paint value, is also emphasized by J. C. Smith in his paper to the International Association for Testing Materials at Copenhagen in 1909, as follows:— "Although opinions vary as to what is theoretically the best pigments or, more correctly, combination of pigments, for the manufacture of protective coatings, the general consensus of technical opinion seems gradually to be that, with certain more or less obvious reservations, the composition of the paint is less important than its physical state, and that one pigment or blend of pigments is more efficient than another as the basis for a protective paint, mainly according to the degree in which it tends to produce certain definite physical and mechanical effects in the ultimate protective film. The problem that remains is the selection of that blend of pigments, suspended in a suitably adjusted vehicle, (the paint as a whole possessing the necessary physical properties), which will, under known conditions as to exposure and climatic conditions, yield a satisfactory protective film. Only exposure tests can solve this problem."

(*C*) *Influence of economic situation on past practice.*

In the past, most steel structures have been superseded because they were inadequate to meet more modern development and not because the lasting quality of the structure had become impaired. The feeling

among engineers in consequence has been that paint materials and the subject of protection were minor considerations, and therefore there has been no economic demand for improved application or shop practice. Because of the demand for steel construction, engineers generally have devoted their attention to developments in design and the subject of conservation or maintenance of the structure has been allocated as of secondary consideration. This is demonstrated by the fact that many engineers ignore the effect of variations in qualities of materials built into an exposed structure and by the fact that most of the tests on corrosion have seldom been completed or followed up. Some engineers are now taking a more active interest in corrosion because of the present demand for conservation. The cost of steel construction and the realization that these are handicapped under present practice by heavy maintenance charges which, if capitalized, would necessitate a very large investment to provide interest to meet them, are apparently responsible for an economic demand to reduce maintenance costs.

Causes of Corrosion

Efficient protection of iron and steel structures by paint can be obtained only when the true causes of corrosion are appreciated and effective means taken both in the design and maintenance of a structure to combat these causes. At the present time no absolutely indestructible or permanent protection is known, but by the use of properly selected paints in conjunction with efficient design and application, maintenance work may be reduced to a minimum much below the present average and the structure maintained without appreciable deterioration.

The deterioration of steel structures is caused by electro-chemical action between the steel and the surrounding elements or, what is often overlooked, by similar action between various members or portions of a structure. A brief explanation of such electro-chemical action in its relation to steel might be worded as follows:—All ferrous metals when placed in water or in an atmosphere which acts as an electrolyte, or in such conditions of exposure that a film of moisture may condense on them, tend to dissolve. This tendency is governed by impurities, unequal stresses and unhomogeneous nature of the metal in each case, and by the impurities in the liquid or gaseous film. Certain points in the metal, which have varying tendencies to go into solution, form electrodes of opposite nature, and corrosion takes place in proportion to the potential difference between these points, governed by the value of the electrolyte connecting them. The more concentrated the hydrogen ions in the electrolyte, (for instance where acids are present), the higher will be its electric conductivity, and the more rapid, consequently, the corrosion of the positive electrode. It is evident, therefore, that in a fabricated structure this action between points applies not only to each surface in detail but to the whole structure where the sections and members may be of varying composition or subject to initial stresses.

Owing to the process of manufacture by heat, steel plates and shapes are always coated with scale which is the black magnetic oxide of iron. This, though it has at first a metallic blue sheen, is not part of the metal, and as it is electro-negative to the steel or iron, it forms a surface which actively promotes corrosion from the moment it is exposed unprotected to the atmosphere. This corrosion is hastened in proportion to the amount of moisture in the air and any acid present. The mill scale as it corrodes changes into a hydrated red oxide of iron holding twenty-four per cent of hygroscopic moisture which is never dried out under atmospheric heat conditions, but acts as an accelerator of further corrosion. As this change takes place the scale increases to more than double its bulk, gradually loosens and flakes off.

Paint applied on top of corroded scale, even though the oil appears to penetrate the scale, will only retard corrosive action but will not neutralize the electronegative polarity or bond the scale to the underlying metal. The oil cannot displace the moisture already present in the scale, therefore the paint merely acts as a covering under which active corrosion proceeds. The gradually increasing bulk of the scale under this action over-stresses the paint film as it is lifted from the metal, while the iron oxide formed has a tendency, where oil or varnish vehicles are used, to make the paint film brittle, with the result that holes and cracks develop in the film through which moisture penetrates under the paint and corrosion is further promoted. Blue mill scale adheres so firmly to the metal that it can only be removed by means of the sandblast or the pickling process. It is also practically impossible to wholly remove partly corroded scale by wire brushes, scrapers or hammers. Under the best practice for protection this also should be removed by sandblast or pickling process. So long as any mill scale remains on the steel surface, one has a potential corrosive agent under the paint which will become active the moment contact can be established through an electrolyte with the metal. An effort along the lines of improvement is illustrated by the fact that the largest steel fabricating shop in this country has recently installed a pickling plant and is prepared, if customers are willing to pay the cost, to treat steel in this way and in consequence remove the mill scale before the first coat of paint is applied.

Building-up a Protective Paint Film

It is evident from the explanation of corrosion that the function of paint is to act as a lasting insulator between the electrodes of varying solution tension or electric potential value, and prevent contact between these and the electrolyte. The problem in practice is not only to obtain this quality, but to combine in the film the following necessary features, the lack of which, would result in expensive maintenance:

1. The film must be suited to the exposure to which the structure is subjected in order that moisture or gas acting as an electrolyte may not penetrate the paint and overcome the insulation.
2. The paint must adhere so closely to the surface that in the event of any local damage to the film no source will be established from which corrosion can creep under the paint and in time remove the whole in flakes or sheets.
3. The film must be tough and elastic in order that it may withstand abrasion and in the event of any mill scale under it, resist for the longest period without fracture.
4. The Paint must be of such a nature that as it loses its value, due to exposure, and recoating becomes necessary, a suitable surface is left on which to apply maintenance paint so that minimum expense may be involved.

Protection by a single application heavy film paint has been sometimes advocated, but in the first place it is almost impossible to obtain such a paint with toughness penetrating the film as required, combined with adhesive

and waterproofing qualities. In the second place, such a film would require to be applied before the steel was fabricated in the structural shops in order to protect the steel before the blue scale became corroded and scaling started, in which case it would probably become damaged during transition through the shops, transportation to the site or during erection of the structure. To arrange for it to be applied in the field after erection of the structure would entail expensive cleaning of the steel under difficult inspection conditions and trouble would certainly arise in the treatment of many inaccessible or intricate built-up sections. Paint makers are constantly experimenting under working conditions at their plants to develop improvements on the protection of steel, but so far, no single coat paint has been developed that has given satisfactory results combined with practical efficiency.

The practice which has produced most satisfactory results has been when a combined film is built up of two or three units, each one adapted to the specific purpose required of it. The combined film must have integral freedom from impurities such that it will not permit outside elements, or ingredients in its composition in conjunction with outside elements, to form electro-chemical combinations and promote corrosion. This film must have sufficient thickness to ensure efficient life as the action of the elements causes gradual oxidation and disintegration.

The first unit of a combined film is the shop coat, the function of which is to prevent the start of electro-chemical action on the surface while the steel is easily accessible and so form a base on which exposure or field coats are placed. As it is the base of all protection, it should receive the most careful consideration. It must dry hard with strong adhesive and anti-corrosive qualities and yet be sufficiently elastic and waterproof to resist damage in the handling of the structure during its transition through the fabricating shops and for a period until the steel is erected, otherwise corrosion of the surfaces is started before the exposure or field coats are applied. It must be a light coat, as otherwise, when used as an assembly paint between surfaces in contact through which hot rivets are driven it is liable to burn out, forming gas pockets and be the cause of loose rivets. It should be easily spread in order that it may be worked into all portions of a built-up section without difficulty by the shop labour.

The second unit in the combined film should be applied on top of the construction or shop coat of paint, after the structure is erected and any abraised portions have been spotted with the shop coat. This paint is required to build up the paint film and form a reservoir life for the exposure paint, also to ensure that the shop paint which has weathered during erection of the structure is reinforced and free from any minute checking, especially if the structure is large and has taken some time to assemble, or where it is composed of light sections the edges of which are difficult to cover with one coat of paint. This paint should be a steel-surface anti-corrosive paint but slightly more elastic than the regular shop paint.

The third unit in the combined film is the one subjected to the exposure and, just as the shop coat is the base on which the paint film is built-up and on which depends the success of protection against electro-chemical action on the surface of the steel, so the function of the exposure coat is to protect the shop coat against the various conditions to which the surface is subjected during its exposure.

It is evident that the conditions which govern steel buried in the ground where the paint film is subjected to fairly uniform temperatures without sudden change but constantly to the action of moisture impregnated with mineral salts, etc., are entirely different to the conditions governing exterior atmospheric exposure where the action of the sun and frost, with temperature variations of over one hundred and twenty degrees Fahrenheit and call for altogether different qualities in the exposure paint film.

One of the causes of high maintenance costs in steel structures is the neglect to apply paint on an exposed surface until not only the field coat of paint has lost its vitality, but corrosion has so far attacked the under coating that bare portions of the steel are exposed, and thereafter applying only one coat of field paint. It should be remembered that in many cases the most effective field coat is not a proper shop or steel-surface paint and that it may not stop corrosion spreading under the surface if it is not applied on top of an anti-corrosive paint. If corrosion is far advanced on a structure, at least two coats of paint should be applied after the surfaces have been thoroughly cleaned, and the first of these should be a real anti-corrosive steel-surface paint fulfilling all the requirements of a shop or construction paint.

Points to be considered in Purchasing Paints

There are one or two essential points in the use of steel paints, however, that should be carefully considered by purchasers when in the market for paint:

1. The manufacturer should always be advised of the exposure to which the paint will be subjected and if possible the nature of the paint already on the surface.
2. Paints containing linseed oil should not be applied on top of asphaltic paint, as action will set up between the paint films and the protective value of both coats will be destroyed.
3. Paints containing linseed oil should not be applied over or under tar paints, as similar action will occur and active corrosion may be immediately promoted.
4. Paints should never be purchased on the basis of price per gallon, as this does not give any comparison of either cost of work or service done. Comparative costs should be based wholly on service records of paint and cost of application per unit of tonnage or area.

It may be of use to have the approximate tonnage of various structures which may be covered by one gallon of good paint, (one coat), based on the thickness of sections:

Sections 3/16 to 1/4 inch thick — transmission towers — 1½ to 2 tons per Imperial gallon.
Sections ⅜ to ½ inch thick — light mill buildings, highway truss spans — 2½ to 3 tons per Imperial gallon.
Section ½ to ¾ inch thick — medium building construction and light railway truss spans — 3 to 3½ tons per Imperial gallon.
Sections ¾ to 1 inch thick — heavy building construction and railway girder spans — 4 to 5 tons per Imperial gallon.

In presenting this paper on "Paint as a Protection for Steel Structures" to *The Institute*, it is the writer's hope that it may awaken interest in this important subject and that an effort may be made to improve the general practice of protection. The results of service records are the base of all future economy and reliable records can be obtained only when an effort is made by everybody interested to co-operate in the selection and use of good paints and their proper application.

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Greetings.

For the greater faith in the profession, for the intense loyalty and enthusiasm for the Institute that has characterized the efforts of our members during the past year we have cause to be thankful.

In acknowledgment of these and the many personal kindnesses extended to him during the year your secretary extends to the members his heartfelt thanks, and, lacking better facilities for sending a personal message to each, takes this opportunity of wishing you, one and all, a joyous Christmas and a brighter happier and more prosperous New Year.

Fraser S. Keith.

Annual Meeting

The annual general meeting of *The Institute* will be held at Montreal on Tuesday, January twenty-third, nineteen twenty-three, at the headquarters of *The Institute.* The meeting will be devoted almost entirely to the business of *The Institute.* There will be no general professional meeting at the time. It is expected, however, that a banquet will be held in the evening, the guest of honour to be one of the most outstanding men in the national life of Canada, provided suitable arrangements can be made.

Two professional meetings are already proposed for next year and are now under discussion by the Branches interested, one to be held in the Maritime provinces and the other at Quebec under the administration of the Quebec Branch. More definite announcements regarding these meetings will be given at a later date.

Making the Library Valuable

How to make the library at the headquarters of *The Institute* of greater value to the membership at large is a problem that has been receiving the attention of the Library and House Committee, and in that connection suggestions would be appreciated from any member of *The Institute.* It is realized that owing to lack of funds for a number of years the library has not been kept stocked with the latest technical books, although as a reference library it is a valuable asset. This year there is available a sum of money voted by Council to the Library and House Committee, and if any member has any suggestion regarding individual books which he thinks should be found in the library, his suggestions will be welcome.

With the existing arrangements between *The Institute* and the United Engineering Societies Library in New York, whereby our members have the privilege of consulting the magnificent library in New York and also securing photostat copies of any article or articles desired, our members have access to practically all of the engineering literature in the world.

In order to make the library of greater value to out-of-town members it is proposed to print a catalogue of the books now available at headquarters. A start on this is being made in *The Journal* where a list will appear each month until the catalogue is completed. It will then be printed in regular catalogue form and made available for the members.

Although we have not at the moment available to be taken from the library the more recently published technical books which would make a valuable addition to the library, it is hoped by making a selection of such from time to time to bring the library eventually to a higher standard of usefulness. In making suggestions the committee would like the title, and names of author and publisher of the book suggested. It is hoped there will be a ready response to this appeal of the Library and House Committee.

Proposed Changes in By-Laws

Approved by Council, Tuesday, November 21st, 1922

The following proposals to change the by-laws of *The Institute* have their origin almost entirely in the recommendations of the Committee on Policy as submitted in their report. This report was approved by professional meetings of *The Institute* at Vancouver and Winnipeg, and in general has had the approval of Council by the appointment of a number of committees suggested in the report.

The changes presented herewith to the membership were prepared by a committee of the Council in which was included the chairman of the By-laws Committee and the chairman of the Committee on Policy. The suggestions to change sections seven, eight, thirty-eight, fifty-seven, sixty, sixty-six and sixty-seven have their origin in Council and are not definitely related to the recommendations of the Committee on Policy.

It is believed by Council that the above proposed modifications are in the interests of *The Institute* and, if put into effect, will work to the benefit and advantage of this organization.

Objects

Section 1:—
Change entire section to read:—

"The objects of *The Institute* shall be (a) to develop and maintain high standards in the engineering profession, (b) to facilitate the acquirement and the interchange of professional knowledge among its members, (c) to advance the professional, the social and the economic welfare of its members, (d) to enhance the usefulness of the profession to the public, (e) to collaborate with universities and other educational institutions in the advancement of engineering education, (f) to promote intercourse between engineers and members of allied professions, (g) to co-operate with other technical societies for the advancement of mutual interests, (h) to encourage original research, and the study, development and conservation of the resources of the Dominion."

Membership

Section 2:— No change.

Section 3:— **Classes of Members**

Change "Associates" to Affiliates" in second and sixth lines, and further change to read as follows:—

"The membership of *The Institute* shall consist of Honorary Members, Members, Associate Members, Juniors, Students, and Affiliates. Members, Associate Members, and Honorary Members who have previously been corporate members, shall be styled corporate members. Juniors, Students, Affiliates, and Honorary Members, who have not previously been corporate members, shall be styled non-corporate members. Non-corporate members shall not be entitled to vote on institute affairs, or to hold office, as an officer of *The Institute*, or as chairman or vice-chairman of a branch, or to vote on branch affairs, except as hereinafter provided. Juniors shall be entitled to vote on branch affairs, and to hold branch offices other than those of chairman or vice-chairman."

Section 4:— **Title**

Change words "Associate" to "Affiliate" in the second and last lines.

Section 5:—**Resident and Non-resident Members**

Change to read:—

"Corporate and non-corporate members residing within Canada and not more than twenty-five miles from the headquarters of a Branch, shall be styled branch residents. Those residing within Canada, but beyond twenty-five miles of a branch headquarters, shall be styled branch non-residents. Those residing outside of Canada shall be styled non-residents."

Section 6:— No change.

Section 7:— **Members**

Change first line to read:—

"A Member shall be at least thirty-five years of age and"

Section 8:— **Associate Members**

Change "twenty-five years of age" to read "twenty-seven years of age" in the first line, and "twenty-eight years of age" to "twenty-seven years of age" in the last line of the first clause.

Sections 9 and 10:— No change.

Section 11:— **Associates**

Change heading to "Affiliates", and in the first line "Associate" to "Affiliate".

Officers

Section 12:—
Change to read:—

"The officers of *The Institute* shall be a president, five vice-presidents, one councillor from each branch having less than two hundred corporate members, two councillors from each branch having two hundred and less than four hundred corporate members, and three councillors from each branch having four hundred or more corporate members."

Section 13:— **Term of Office-Vacancies**

Change clause one to read:—

"The term of office of the president shall be one year, of the vice-presidents two years and of the councillors one year, except in the case of councillors from branches of over two hundred corporate members. The term of office for such councillors shall be two years for those representing branches having a corporate membership of two hundred and less than four hundred, and three years for those representing branches having a corporate membership of over four hundred, one councillor to be elected each year from each branch."

Note for the Ballot:—
"For the first election of councillors under this by-law, elections shall be held only as necessary to maintain the provisions of this by-law allowing the councillors in office to complete their term."

Clauses two and three, no change.

Clause four:—

Add after the word "Councillor" in the second line the words "from the zone in which the vacancy occurs".

Change last clause to read:—

"A vacancy in the office of councillor shall be filled until the following annual election by a corporate member chosen by the council from a list of nominees submitted by the executive of the branch concerned."

Sections 14 to 25, inclusive, no change.

Section 26:— Delete entire section.

Note:—Renumber all following sections to allow for deletion of section 26, and renumber other sections in the interests of uniformity.

Sections 27 to 32, inclusive, no change.

Fees

Section 33:— **Entrance Fees**
Change the word "Associates" to "Affiliates" and the entrance fee of Affiliates from $15.00 to $10.00.

Section 34:— **Annual Fees**
Change the words "Associates" to "Affiliates" in the three places and the annual fee of "Affiliates" from $13.00 to $10.00 in each case.
Add the words "Montreal Branch" after the word "by" in the first line, and add the words "all other" after the word "by" in the eighth line.

Sections 35 to 37, no change.

Section 38:— **Arrears-Exemptions-Retired List**
Change words "Retired List" to "Life Membership List" in the title and in the last line of clause three. In clause three, add after "thirty-years" in fourth line the words "or who has rendered signal service to *The Institute*."

Sections 39 to 49, inclusive, no change.

Section 50:— **Branch Membership**
Change to read:—

"The membership of a branch shall consist of the members of *The Institute* of all classes residing within a distance of twenty-five miles from the headquarters of the branch and the members of all classes residing within an area so allocated that such members are members of the branch most convenient geographically, branch districts to be so apportioned that all members of all classes resident within the Dominion shall be members of a branch. The boundaries of the branch districts shall be determined by the council.

A non-resident member shall have the right to designate himself a member of any branch he may choose, failing which designation he shall be attached, for Institute voting purposes only, to the Montreal Branch.

Branches may at their option admit to branch privileges persons not members of *The Institute*, which persons shall be styled "Branch Affiliates." The qualifications, fees and privileges, of Branch Affiliates, shall be such as may be specified by branch by-laws."

Sections 51 to 56, inclusive, no change.

Section 57:— **Revenue**
Change to read:—

"The secretary of *The Institute* shall each year remit to each branch a rebate of the annual fees, current or arrears, received from the members of that branch during that year, payments being made quarterly, as follows:— Thirty per cent to all branches having a corporate membership of less than one hundred; twenty-five per cent to all branches having a corporate membership of one hundred and less than two hundred; and twenty per cent to all branches having a corporate membership of two hundred or more."

Sections 58 to 59, no change.

Provincial Divisions

Section 60:— **Management**
Change to read:—

"Each provincial division shall be managed by an executive committee consisting of (a) those members of council resident within the division, (b) one representative to be appointed by the executive of each branch of the division, (c) the officers of the division, (d) the past-chairman and the past secretary-treasurer for the year following their term of office."

Sections 61 to 64, inclusive, no change.

Nominations and Elections of Officers

Section 65:— **Electoral Districts**
Change to read:—

"For the purpose of the nomination and election of officers the membership of *The Institute* shall be divided into branch districts for the election of councillors, and zones for the election of vice-presidents. The branch districts shall be determined by the council. The four vice-presidential zones shall be (a) the four western provinces, (b) the province of Ontario, (c) the province of Quebec, and (d) the Maritime provinces."

Section 66:— **List of Members**
Change to read:—

"Council may direct that a list of members with the names arranged alphabetically and geographically, indicating the zones and branches, be sent to corporate members each year not later than August first."

Section 67:— **Election of Nominating Committee**
Change to read:—

"The nomination of officers of *The Institute* shall be made by a nominating committee. The honorary councillors shall be ex-officio members of this committee. The remaining members who shall not be officers of *The Institute*, shall be elected annually as follows:—Each branch shall appoint one member, an additional member appointed by the council shall be chairman of the committee. The membership of the committee shall be announced at the annual general meeting."

Section 68:—**Nominating Committee to Prepare Officers Ballot**
Clause one, no change.

Clause two:—
Change to read:—

"A vice-president shall be elected by vote of the corporate members resident within the zone for which he is a candidate, an election to take place every two years in each zone, except in zone (c) where an election shall take place each year. One vice-president shall be elected from each zone, except zone (c) from which two vice-presidents shall be elected, one of whom must be resident within twenty-five miles of the headquarters of *The Institute*."

Clause three:—
Change to read:—

"A councillor shall be elected by vote of the corporate members resident within the branch district for which he is a candidate."

Clauses four and five, no change.

Note for the first ballot under this by-law:—

"For the first election of vice-presidents under this by-law, elections shall be held only as necessary to maintain the provisions of this by-law allowing the vice-presidents in office to complete their term."

Clauses under "Nominees for Officers Ballot sent to Members" and "By-laws", no change.

The Officers' Ballot

Clause one:—

Change the word "District" in the third line, to "zone or branch district", and the word "Districts" in the fifth line, to "zones and branches."

Clause two:—

Change the tenth word in the fourth line "Councillors" to "councillor" and the word "District" to "branch" in the fifth line.

The balance of the by-laws;— no change.

New Honorary Member

Entrance to the classification of honorary membership in *The Institute* has always been closely guarded in order that the high standard be maintained. When a non-member is made an honorary member it is in recognition of the high place he occupies in national or educational affairs. When an engineer is admitted to this distinction it is one of the greatest tributes that can be paid him by his fellow engineers, and is an acknowledgement of the high position he occupies in the profession, both professionally and in virtue of the services he has rendered.

It is fitting therefore, that C. E. W. Dodwell, B.A., M.E.I.C., should be chosen to be admitted to this select coterie. On Tuesday, November twenty-first, nineteen twenty-two, Mr. Dodwell, one of the prime movers in the establishment of the Canadian Society of Civil Engineers, the father of engineering legislation in Canada, and at all times a capable and active worker on behalf of the profession, was unanimously elected to honorary membership in *The Institute*. Mr. Dodwell is one of the best known and most highly respected engineers in Canada, and in conferring this tribute of respect and esteem upon him by the Council, it was felt that by so doing another distinguished name is being added to those already on the list.

PERSONALS

D. W. Hays, M.E.I.C., has opened an office in the Herald Building, Calgary, consulting in irrigation work.

M. A. Sammett, A.M.E.I.C., of Montreal, has left for an extended trip on account of ill health. His practice has been taken over by J. A. Burnett, M.E.I.C.

H. G. Wellsford, A.M.E.I.C., has been transferred from the Dominion Bridge Company, Limited, Winnipeg, to the Montreal office of the same company.

H. J. MacKenzie, M.E.I.C., is now with the Nova Scotia Provincial Highways Board as construction engineer at Monastery, Antigonish county.

S. K. Payzant, Jr.E.I.C., who received his degree of B.SC., from Acadia University in 1914, is now located at Talara, Peru, South America.

Spencer Ball, Jr.E.I.C., who received his degree of B.Sc., from the University of Saskatchewan, in 1916, has accepted a position with the sewer section of the works department of the city of Toronto.

Stephen Williams, S.E.I.C., has accepted a position with the Imperial Oil Company at Sarnia, in their draughting department. Mr. Williams is a graduate of Royal Military College, Kingston.

Grant S. Sherman, A.M.E.I.C., has accepted a position on the engineering staff of the National Aniline and Chemical Company of Marcus Hook, Pa., and is located at Wilmington, Del.

M. D. Ross, S.E.I.C., of Chatham, Ontario, who graduated this year in electrical engineering from the University of Toronto, is now connected with the Westinghouse Company at East Pittsburg, Pa.

Donald H. Macfarlane, Jr.E.I.C., who graduated from McGill University, in 1921, has accepted a position as draughtsman and associated with H. A. Budden, A.E.I.C., advocate and council in trade mark and patent cases, of Montreal.

J. Aggiman, A.M.E.I.C., has charge of the construction and manufacturing department of the Standard Oil Company for the Near East, being stationed at Constantinople. Mr. Aggiman received his degree of B.Sc., from McGill University, in 1917.

H. E. Mott, S.E.I.C., who received his degree of B.Sc., in electrical engineering from McGill University this year, has accepted the position as engineer in charge of the testing department of Marconi Wireless Telegraph Company of Canada Limited, at Montreal.

H. S. Bare, A.M.E.I.C., who for a number of years was with the Canadian Pacific Railway, as resident engineer of the Angus shops, and resident engineer of the Montreal terminals, and building engineer in charge of construction of the Angus shops, is now located with the Gurney Scale Company, Montreal.

D. G. Calvert, A.M.E.I.C., is resident manager and treasurer of the Fort William Paper Company, Limited, having charge of the operation of the company's large groundwood mill and construction department, which is just completing a two machine newsprint mill. M. Turner, A.M.E.I.C., is construction superintendent for fhe company.

L. W. Lester, A.M.E.I.C., is now assistant engineer with Charles Hawley and Company on a hydro-electric construction project on the Clarion river in Pennsylvania. Before leaving for Clarion, Mr. Lester was connected with the Manitoba Power Commission as surveying engineer.

C. H. M. Burns, A.M.E.I.C., formerly chief engineer with the Maritime Coal Railway and Power Company, and who is now mining engineer specializing on the mechanical equipment of mines and the preparation of coal, in Philadelphia, has been elected a member of the American Society of Mechanical Engineers.

J. G. Lennox, A.M.E.I.C., has accepted a position with Fetherstonhaugh and Company, Montreal. Mr. Lennox has had considerable experience in the design and erection of mechanical, electrical and structural work in Glasgow and in design and estimating, with the mechanical department of the Dominion Bridge Company, Lachine.

A. A. Turnbull, Jr.E.I.C., is with the New Brunswick Telephone Company at St. John, N.B. Mr. Turnbull was attending Dalhousie University when war was declared and returned to complete his course after three years on active service, during which time he served as Lieutenant in the 4th Battalion, Canadian Machine Gun Corps.

A. R. Hannaford, A.M.E.I.C., has accepted a position as office and designing engineer with the city engineer's department, Hamilton, Ontario. On coming to Canada from England some twelve years ago, Mr. Hannaford joined the engineering staff of the Grand Trunk Railway and continued on various works with the railway, until accepting his present position.

J. F. Lumsden, A.M.E.I.C., has accepted a position with the Nova Scotia Power Commission. Mr. Lumsden received his degree of B.Sc. in electrical engineering from the Nova Scotia Technical College in 1911. Prior to accepting this position Mr. Lumsden was professor in electrical engineering in the Nova Scotia Technical College.

Oswald Milne, S.E.I.C., who has had varied experience in the draughting departments of the British American Shipbuilding Company, and the Canada Steel Foundries Limited of Welland, and later had complete charge of design and draughting work for P. Payette Company, Penetanguishene, has accepted a position on the engineering staff of the Waterous Engine Works Company, Limited, at Brantford, Ont.

G. F. Alberga, Jr.E.I.C., who graduated from McGill University with the degree of B.Sc., is now superintendent of parochial roads and works, May Pen P.O., Jamaica, B.W.I. Before leaving for Jamaica, Mr. Alberga had been connected with the bridge department, Canadian Pacific Railway, Montreal, and more recently on the staff of the mechanical engineering department of McGill University.

J. A. Burnett, M.E.I.C., consulting and appraisal engineer, has taken over the office of M. A. Sammett, A.M.E.I.C. Mr. Burnett has had a wide experience with the Royal Electric Company, Canadian General Electric Company; construction of a large sub-station for the Montreal, Light Heat and Power Company; construction of the Montreal and Southern Counties Railway, and the appraisal of all the electrical equipment on the Grand Trunk System for the Government arbitration.

W. H. Snelson, A.M.E.I.C., of the Calgary Branch, has prepared a bulletin, which has been recently issued by the Reclamation Service, dealing with irrigation practice and water requirements for crops in Alberta. While intended primarily for the instruction of farmers on irrigated lands it is of interest to engineers engaged in irrigation work in that it visualizes the processes needful after construction of canals is finished, and gives authentic data on the quantity of water that can be used to advantage in producing crops in this climate.

Geo. R. Pratt, A.M.E.I.C., fuel engineer for the province of Alberta is the author of a particularly interesting booklet entitled "Coal Truths" which has recently been published by the Coal Truth office of the Mines Branch of the province of Alberta. While primarily designed to be of service to the domestic user of Alberta soft coals, it contains much of interest to all users of coal. The text is so written that it may be understood by all and is well illustrated with a large number of plates many of which are in colours.

R. L. Hearn, A.M.E.I.C., is now assistant chief engineer with the Washington Water Power Company, Spokane, Washington. After graduating from the University of Toronto in 1913 with the degree of B.A.Sc., Mr. Hearn was with the Dominion Bridge Company, Limited, at Lachine, as draughtsman, and later with the Hydro-Electric Power Commission of Ontario, as designer on Wasdells Falls power development. On the Eugenia Falls development, he was shop inspector for steel penstock and surge tank, and was assistant engineer on design, charge of designing and draughting, on the Queenston-Chippawa development.

Thomas Taylor, M.E.I.C., is now engineer of railway and bridges with the Department of Works of the city of Toronto. After graduating with honours from the School of Practical Science, University of Toronto, in 1902, Mr. Taylor was for a number of years engaged on structural steel work, detailing, designing and estimating with the Riter Conley Construction Company in Pittsburg, Pa.; the McClintic-Marshall Construction Company; and the Canada Foundry Company. Mr. Taylor joined the engineering staff of the city of Toronto in 1912 and was connected with the construction of the Bloor street viaduct from the time of the preliminary surveys, in the capacity of designing and construction engineer.

Frederick H. Moody, Jr.E.I.C., who graduated with the degree of B.A.Sc. in mechanical engineering, from the University of Toronto, has been elected president of the Canadian Electrical Equipment Company, Limited, which company is the sole Canadian representative for the Valley Electric Company, and also representatives for the Towmotor Company, and the Cleveland Crane and

Engineering Company of Cleveland, Ohio. Following graduation, Mr. Moody had considerable experience in editorial work being associate editor of the "Canadian Machinery" and "Power House", in 1910, and of "Machinery", New York, in 1911, and mechanical and engineering editor of the "Railway and Marine World" for following year.

H. Alton Wilson, A.M.E.I.C., until recently technical editor with the McLean Publishing Company in Montreal, has been appointed managing editor of the Daily Intelligencer at Belleville, Ontario. Mr. Wilson is a graduate in mechanical and electrical engineering of the University of Toronto, 1911, and was for a number of years engineer for the J. C. Wilson and Company, Glenora, Ont., engaged in the manufacture of turbines and power transmission machinery. During the war Mr. Wilson was engineer and manager in charge of a munition factory at Belleville, Ont., manufacturing high explosive shells and subsequently was appointed equipment engineer for the North East Electric Company, at Rochester, New York.

J. L. Busfield, M.E.I.C., formerly secretary-treasurer of the Montreal Branch, has entered into partnership with de Gaspé Beaubien, M.E.I.C., and is engaged in general consulting engineering practice under the name of Beaubien, Busfield and Company, with headquarters in Montreal. Mr. Busfield has had extensive experience in railway engineering and hydro-electric development, having been for several years assistant engineer with the Mount Royal Tunnel and Terminal Company, and for the past five years, principal assistant to Walter J. Francis and Company, of Montreal, in charge of various power investigations, valuations and construction. Mr. Busfield is at present in Winnipeg, on work for the Manitoba Power Company.

J. J. Hanna, A.M.E.I.C., is now engaged on the construction of an oil refinery for the Imperial Oil Company at Calgary. Prior to accepting this position Mr. Hanna was with the Lethbridge Northern Irrigation district. Mr. Hanna graduated in 1914 from the University of Toronto with the degree of B.A.Sc., and was with the Canadian Pacific Railway as assistant engineer of the hotel department with supervision of operation and maintenance, and charge of all surveying and draughting for hotel grounds through the Rocky mountains, and also supervision of construction and maintenance of mountain trails. In May 1914 he was appointed as assistant in the roadway department of the city engineer's office at Calgary, from which position he resigned in August of the same year to go overseas.

W. D. Adams, A.M.E.I.C., has severed his connection as assistant engineer with the Toronto Transportation Commission and is now employed with Walter J. Francis and Company, in Toronto. After graduating from the Royal Military College, Kingston, in 1908, he was appointed assistant engineer, middle division of the Grand Trunk Railway. In 1910, he was in charge of the engineering department of the Canadian Buffalo Forge Company, Montreal, and, from June of that year until August 1914, he was assistant engineer, grade separation, railway and bridge section of the Department of Works of the city of Toronto. On returning from overseas in September 1919, he became a partner with Adams Brothers of Toronto until he joined the staff of the Toronto Transportation Commission in January 1921.

T. D. Mylrea, A.M.E.I.C., has been appointed assistant professor in structural engineering, University of Illinois. After graduating from the University of Illinois in 1909 with the degree of B.Sc. in civil engineering, Mr. Mylrea was engaged with the American Bridge Company as draughtsman and checker. Later he was checker and then chief draughtsman with the Winnipeg plant of the Dominion Bridge Company; designer with Harkness and Oxley; science master with Ingersoll Collegiate Institute; and engineer of tests, Toronto City Architect's department, and while with the City Architect's department Mr. Mylrea made an extensive study of the effects of fire upon the concrete building of the Quaker Oats Company's plant. More recently he has been with the Toronto office of the Trussed Concrete Steel Company as chief engineer, and later engineer with Norman McLeod, Limited, Toronto.

Appointed Industrial Lecturer, University of British Columbia.

MAJOR GEORGE A. WALKEM, B. Sc. M.E.I.C.

Major George A. Walkem, B.Sc., M.E.I.C., has been appointed lecturer in industrial management on the staff of the department of mechanical engineering at the University of British Columbia. As pointed out by president L. S. Klinck, Major Walkem is the first to volunteer to give his services for any extended period free of charge to the university and in this connection President Klinck alluded to the fact that Major Walkem's father had been a well-known lecturer at Queen's University, Kingston, Ont.

Major Walkem who was elected Councillor this year has been an active member of *The Institute* since 1906. His long experience in consulting mechanical

engineering and as the head of prominent engineering and equipment companies on the Pacific coast, makes his services under his new appointment of special value to the university.

Secretary of Association of Professional Engineers of Ontario.

R. B. Wolsey who was appointed secretary-treasurer and registrar of the Association of Professional Engineers of the Province of Ontario has been for some weeks actively engaged in the work of registration of engineers from all parts of the province, with headquarters at the Engineers Club, Toronto.

R. B. WOLSEY

Mr. Wolsey is prepared to give the fullest information regarding the new association to all inquirers, and the association is fortunate in having available at the outset the experience gained by him in his capacity as secretary, treasurer and acting registrar of the Ontario Association of Architects during the past nine years, and as secretary of the Engineers Club of Toronto.

Mr. Wolsey was born in England and received his early education at Dereham and Argyll College, London, and his engineering training in the office of Mr. Martin, a noted engineer and architect of Westminster. Since coming to Canada thirty-one years ago Mr. Wolsey has been connected with the Cleveland Electric Railway, Goodrich Rubber Company, Morgan Engineering Company, United Electric Company and Canada Foundry Company.

Trade Publication

Canadian Link-Belt Company Ltd. A four page circular letter, advertising the publication of their new general catalog No. 400 has been received by us from Canadian Link-Belt Company. This circular carries a letter on the first page suggesting that engineers, superintendents and purchasing agents send for a copy, and provision is made on the last page for eight separate requests. The two inside pages are devoted to an illustration of the catalog, and as this illustration is in colors, the effect is novel and striking. Requests for this catalogue should be addressed to the company either in Toronto or Montreal.

EMPLOYMENT BUREAU

AND MEMBERS' EXCHANGE

To make this department more valuable it is proposed that in future advertisements of situations vacant should state salary, and give details of requirements.

Situations Wanted

Civil Engineer

Civil engineer, 1922 graduate, three seasons experience on survey work, desires position, preferably water power development. Salary not governing feature provided there is opportunity of advancement. Available now. Apply Box No. 124-P.

Mechanical Engineer

Mechanical engineer desires permanent position, 20 years experience including supervision of erection, operation and repairs of large gas engines and oil engines, gas producers, steam turbines and general engineering work; have also a fair knowledge of selling. Available to take charge of any undertaking where my experience will be of mutual advantage. Apply Box No. 125-P.

Industrial Engineer

Graduate in Arts and Science. General experience in design and construction of mill buildings. Thoroughly experienced in maintenance and repair work, and testing of equipment, as applied in modern paper mill practise. Open for engagement. Apply Box No. 126-P.

Mechanical Engineer

Mechanical engineer, A.M.E.I.C., age 32 years, married, fourteen years experience in marine engineering, desires responsible position with firm of consulting engineers either marine or steam power plant. Have experience in management and repair of high powered reciprocating and turbine engines, also Diesel engines, water-tube and tank boilers of all sizes, oil fuel and coal burners. Eight years in responsible position with rank of Engineering Lieutenant in R.C.N. Apply Box No. 127-P.

Situation Vacant

Engineering Salesman

British instrument firm requests applications for position of travelling engineering salesman. Must have knowledge of power plant instruments also civil engineering and draughting requisites. Young unmarried man of good personality. State full qualifications and experience also salary desired. Apply Box No. 219.

Assistant Chemist

An Assistant Chemist in the Foods and Drugs Division of the Department of Health at Ottawa, at an initial salary of $2,100 per annum, which will be increased upon recommendation for efficient service at the rate of $120 per annum, until a maximum of $2,580 has been reached. This salary will be supplemented by whatever bonus may be provided by law.

Duties.—Under supervision, to make chemical analyses and physical examinations of substances; analyzing foodstuffs and drugs; determining the nutritive value of foods; following prescribed methods of analysis not requiring extreme accuracy, and to perform other related work so assigned.

Qualifications.—Education equivalent to graduation from a university of recognized standing with special training in analytical chemistry; preferably one year of laboratory experience.

Examination.—Rating on Education and Experience, from the sworn statements submitted by applicants on their application forms, Weight 5; Oral Examination, if necessary, Weight 5.

Application forms properly filled in must be filed in the office of the Civil Service Commission *not later than December 14.* Application forms may be obtained from the offices of the Employment Service of Canada, from the Postmasters at Prince Rupert, Vancouver, Victoria, Edmonton, Calgary, Regina, Winnipeg, Quebec, Charlottetown, Halifax, Fredericton, and St. John, or from the Secretary of the Civil Service Commission.

By Order of the Commission.

W. FORAN, *Secretary.*

Members' Exchange

Cook Transit, 1896, overhauled at Cook's Works, York, England in 1910. 5 inch horizontal circle divided to 30 seconds. 5 inch verticle circle divided to 30 seconds. Single opposite verniers at right angles to line of sight. 3 level adjustment; 1¼ inch aperture; trough compass with tripod, price $100. Box No. 27-A.

Publications

Practical Accounting for General Contractors:—A text book for the accounting systems of contracting organizations, by H. D. Grant, of the staff of W. B. Richards and Company, accountants and engineers, has been recently published by McGraw-Hill Book Company, Inc., New York. While every accounting system, to be successful, must be adapted in its details to the particular conditions existing, this book sets forth principles and basic records which govern the keeping of accounts for general contractors. The book is divided into three parts; first, financial accounting, with chapters describing various types of contracts, financial accounts and records to be kept, and the preparation of financial statements, — second, field accounting control, giving details of cost accounts, the field accounting organization and personnel, the method of handling accounts and necessary records, and the preparation of the monthly report, — and third, miscellaneous matters in which are discussed payroll problems, control of equipment, preparation of estimates and bids, municipal contracts and legal aspects of contracts.

Theory of Wave Transmission. — A treatise on transmission of power by vibrations, by George Constantinesco, the second (revised) edition of which has been published by Walter Haddon, 132, Salisbury Square, London, E.C. 4, proprietor of patents controlling wave transmission. Commencing with a statement of the elementary principles involved, and definitions of the various parts of the system, the book deals at some length with the theory of transmitting power by means of vibration of the medium employed, whether solid, liquid or gaseous. According to the new system, energy is transmitted from one point to another, which may be at a considerable distance, by means of impressed periodic variations of pressure or tension producing longitudinal vibrations in solid, liquid or gaseous columns. A chapter is devoted to the principles of the motors developed for use in connection with the system, while the various other apparatus, required for the system, such as, condensers, inertias, leakage devices, and transformers, are also fully dealth with.

ELECTIONS AND TRANSFERS

At the meeting of Council held on November 21st, 1922, the following elections and transfers were effected:—

Members

CHRISTIE, William, B.A.Sc., (Univ. of Toronto), surveyor engr., Topographical Surveys Branch, Department of the Interior, Ottawa, Ont.

SOUBA, William Henry, M.E. (Minnesota Univ.), partner, C. D. Howe and Company, consulting engineers, Port Arthur, Ont.

Associate Members

BONNELL, Mossom Burwell, B.A.Sc. (Univ. of Toronto), examiner in chg. of divn. of elec'l. apparatus, Canadian Patent Office, Ottawa, Ont.

DUNLAP, Henry Joseph, B.Sc. (Queen's Univ.), asst. magnetician, Topographical Surveys Branch, Department of the Interior, Ottawa, Ont.

FREELAND, Edward Ewing, B.A.Sc. (Univ. of Toronto), topog'r. engr., Topographical Divn., Geological Survey, Dept. of Mines, Ottawa, Ont.

HATTON, Gerald Percy, B.A., B.E. (Royal Univ. of Ireland), engr'g. clerk, levelling office, Topographical Surveys Branch, Department of the Interior, Calgary, Alta.

NIXON, Norman James, B.Sc. (Queen's Univ.), foreman engr. Northern Electric Company, Montreal, Que.

SAUNDERS, Clarion Spencer, general manager, The Shawinigan Engineering Company, Limited, Montreal, Que.

STRAIN, John Walker, building contractor, partner of firm, Strain and Emery, Limited, Windsor, Ont.

Juniors

JOB, Stanley Robert, designing dftsman., H.E.P.C., of Ontario, Welland, Ont.

WARNER, Donald Franklin, S.B., (Mass. Inst. of Tech.), turbine circulator, General Electric Company, West Lynn, Mass.

WHITEHILL, Peter, B.Sc. (C.E.-Univ. of Man.), of 301, Inkster Blvd., Winnipeg, Man.

Transferred from the class of Associate Member to that of Member

BROWN, Arthur Charles, ch. engr., J. P. Porter, Standifer and Porter Bros., contrs., sections 1 and 2, New Welland Ship Canal, St. Catharines, Ont.

DISNEY, Charles P., engr. of bridges, Eastern Lines, C.N.R., Toronto, Ont.

JOHNSTON, Harold Stanley, B.Sc. (McGill Univ.), hydraulic engr., Nova Scotia Power Commission, Halifax, N.S.

JONES, Harold William, B.Sc., (McGill Univ.), Tidal and Current Survey, Department of Marine, Ottawa, Ont.

LAWRENCE, William Dawson, B.Sc. (McGill Univ.), supt. engr., McGill University, Montreal, Qϵe.

Transferred from the class of Junior to that of Associate Member

EMREY, Joseph Desmond, B.Sc. (Queen's Univ.), field supt., Bridge Dept., Canadian Des Moines Steel Company, Ltd., Chatham, Ont.

IRVING, James C., B.C.E. (Univ. of Man.), district engr., Good Roads Board, Winnipeg, Man.

MACKENZIE, Gordon Leslie, B.Sc. (C.E.-Queen's Univ.), associated with J. E. Underwood, consltg. engr., Saskatoon, Sask.

STRATHY, Rolph Lee Alexander, B.Sc. (E.E.-McGill Univ.), testing department, Canadian General Electric Company, Peterborough, Ont.

WHITTIER, Albert Ronald, B.Sc. (Queen's Univ.), asst. to Superintending Engineer, of Rideau Canal, Ottawa, Ont.

Transferred from the class of Student to that of Associate Member

AFFLECK, John Knox, B.A.Sc. (Univ. of Toronto), works chemist, Imperial Varnish and Colour Company, Toronto, Ont.

JOHNSON, G. Alan, B.Sc. (McGill Univ.), factory manager, Robert Mitchell Company, Limited, Montreal, Que.

Transferred from the class of Student to that of Junior

HEENEY, Terrence James Clifford, asst. to cable engr., engr'g. dept., Northern Electric Company, Limited, Montreal, Que.

BRANCH NEWS

Victoria Branch

Horace M. Bigwood, A.M.E.I.C., Secretary.

The initial meeting of the Branch for the year was held on Wednesday, November 8th, at the Branch rooms, 25 Brown building, and was attended by a good number of members.

The meeting was fortunate in having Major Geo. A. Walkem, M.E.I.C., councillor for District No. 10, present to address it on the subject of "Policy". The whole of the ground covered by the report of *The Institute* committee dealing with the subject was very ably reviewed by the speaker, particular points being discussed at length. As the discussion showed, and as several members remarked, the report was but indifferently understood or appreciated by a large majority of *Institute* members, and yet when brought directly to their attention its important bearing towards the membership at large was readily seen.

'Legislation,' the evergreen topic in so far as the Victoria Branch is concerned, was introduced and the probable bearing of the report on possible action of *The Institute* towards co-ordination of existing legislation was discussed, Mr. Philip, the chairman, leading the discussion, and voicing the hope that before very long universal legislation throughout the Dominion with the E.I.C. at least nominally the pivot about which all turned, would be a reality.

Major Walkem spoke of his own various activities in public matters and advocated more interest on the part of engineers as individuals in the sphere of public life. Dominion, provincial and municipal politics were all open to engineers who were willing to take part. Agreement in this view was expressed by another speaker who described the Major as the first self-assertive engineer that he had met.

This being the meeting immediately prior to the annual meeting, which will be held on Wednesday, December 13th, nominations for officers for the coming year were made.

On Monday, December 11th, a lecture on the railway construction work of the Royal Engineers in Palestine will be given under the auspices of the Branch. Considerable difficulty has been experienced in the past in securing papers to be read at meetings of the Branch and it is proposed, when free evenings occur, to try and induce one or more members to read five or ten minute papers dealing with small details of the work upon which they are immediately engaged, or with problems they have met with the method adopted for their solution. It is thought by this means to create interest in meetings, promote discussion and give information without great expenditure of time.

St. John Branch

Harry F. Bennett, A.M.E.I.C., Secretary-Treasurer.

Visit of the General Secretary

The St. John Branch gave the General Secretary a royal welcome on November 6th, and 7th, when he visited St. John on his tour of the Maritime Provinces. Owing to November 6th, being a holiday, no definite programme was arranged and Mr. Keith spend the day among friends in the city. On Tuesday, November 7th, F. M. Ross, Affiliate of the St. John Branch, general manager of the St. John Dry Dock and Shipbuilding Company, Ltd., invited the engineering staffs of the Dominion Public Works Department to lunch with Mr. Keith at Courtenay Bay. Before luncheon, the party visited the suction dredge "Tornado", at work in the new harbour and the advantages of the oil burning equipment which has recently been installed were pointed out. The party was greatly impressed with the apparent efficiency of the plant which has a record for twenty-two days of 329,000 cubic yards removed.

About thirty-six engineers and other guests sat down to lunch in the company's dining hall and rapidly devoured the splendid food presented for their approval. Alex. Gray, M.E.I.C., engineer in charge of St. John harbour, expressed the sentiments of the gathering when he thanked Mr. Ross for his hospitality. He explained that no expense had been spared in making this dry dock second to none on the North American continent. He was very glad that the engineers of the department had this opportunity of seeing the work being done. Fraser S. Keith, M.E.I.C., expressed his pleasure at being present at such a happy gathering. He felt that greater interest was being taken in this work in Montreal than in St. John, and he hoped that on completion a large gathering of engineers might take place at the formal opening. He wished the company every success in its undertaking.

F. M. Ross said he was pleased to have the engineers as the guests of the company at this time and he knew that they would all be satisfied after the inspection of the works that St. John was going to have a dock of which any country should be proud. They had met difficulties, many of them, but they had been overcome and he was proud of the work accomplished by the engineers with whom he was associated.

The party made a tour of the dock and accessory plant and those who had not had the opportunity of visiting the work recently were amazed at the progress. The dock itself, which will have a total length of 1,150 feet, is divided into two small docks, the outer of which is nearing completion. The steel for the caisson at the entrance is now being assembled. Work is progressing on the waiting and fitting-out berths at the entrance. It is hoped that a full description of this magnificient dry dock will be available for publication in *The Journal* early in the new year. In addition to the dry dock, a marine railway is to be erected on the north side of the dock, capable of handling small craft up to 2,000 tons.

Complimentary Dinner

On the evening of November 7th, the Branch gave a complimentary dinner to Fraser S. Keith, at which forty-four members and guests sat down to a splendid repast at Bond's restaurant.

After the toast to the King, Frank P. Vaughan, M.E.I.C., proposed a toast to the E.I.C., to which C. C. Kirby, M.E.I.C., replied. Mr. Kirby dwelt on the aims of *The Institute*, its endeavours to promote legislation for the benefit of engineers generally, and its policy for the

future. He also took up the work of the local Branch and pointed out its opportunities for service. A. G. Tapley, A.M.E.I.C., chairman of the gathering, proposed a toast to the General Secretary, which all present drank most enthusiastically to the accompaniment of musical honours.

In replying to the toast Mr. Keith said he was overwhelmed by the enthusiastic reception he had received in the city, he was having a wonderful time and would return to Montreal assured that the E.I.C., was held in high regard in these provinces. He then took up the several items in the report of the Committee on Policy and that on Classification and Remuneration. In a forceful manner he impressed the members with the progress being made along lines of vital interest to all. The close attention paid to the speech and the applause at its conclusion showed that his work and that of *The Institute* generally, was appreciated.

Various musical numbers were interspersed among the speech and all combining to make the event an enjoyable one.

The St. John Branch began its winter programme on Thursday, October 19th, when the members had the opportunity of hearing J. A. Coderre, of the Forest Products Laboratories, Montreal, speak on "Preservation of Timber from Marine Borers". A. G. Tapley, A.M.E.I.C., was in the chair, and before the paper various matters pertaining to the work of the Branch were discussed; the Branch endorsed the suggestion of the Committee on Policy to pay the expenses of the Councillors to one Council Meeting.

St. John Branch visits new Dry Dock, November 7th, 1922

1 E. A. Thomas; 2 V. S. Chestnut; 3 E. G. Cameron; 4 J. M. Lamb; 5 F. M. Barnes; 6 B. Allen; 7 W. C. Ewing; 8 G. Stead; 9 F. M. Ross; 10 G. E. Martin; 11 A. G Tapley; 12 G. H. Thurber; 13 F. G. Goodspeed; 14. W. J. Johnston; 15 H. R. Logie; J. H. McKinney; 17 S. H. Vaughan; 18 A. Gray; 19 H. D Macauley; 20 C. S. Bennett; 21 W. V. Delaney; 22 A. A. Dodge; 23 F. P. Vaughan; 24 F. S. Keith.

Mr. Coderre, with the aid of lantern slides, described the physical characteristics of the various marine borers. He showed how the mollusc bored into the wood and still received its food from the surrounding waters. The boring action was apparently the means it had of maintaining a home and the wood was not used as a food. The crustaceans, however, are very small in comparison to the molluscs, but bore to a considerable distance into the wood and use it as a food.

Mr. Coderre explained that the Forest Products laboratories had experimented with the various woods available, and with various methods of treatment in order to develop means of overcoming the action of marine borers. It had been found that creosoting, either by the pressure or open tank treatments would prevent the borers from destroying the wood. The great difficulty experienced was the necessity of fashioning the timbers after leaving the creosoting plant, and the smallest opening into the untreated wood would afford sufficient opportunity for the pests to establish themselves. There appeared to be but one way of overcoming this difficulty and that was by the establishment of creosoting plants near the localities where such timber was needed.

Experiments with various timbers had shown that spruce and hemlock, which are the principal construction timbers in the Maritime Provinces, would not take sufficient creosote to form a perfect seal against the borers. The structure of the wood itself was the cause of this and it would be necessary to use different native woods if creosoting was undertaken. The jack pine, also called princess pine, is a good structural timber and will take a large percentage of creosote. Birch and poplar could also be used with satisfaction. If round timber is to be treated, care must be taken that every particle of bark is removed, as the creosote would not penetrate through the bark. To obtain ideal conditions it is necessary to treat all timber after the framing and boring for bolts is completed; then it is possible to have a material proof against the ravages of marine borers.

At the conclusion of the paper numerous questions relating to the subject of marine borers and creosoting were asked, especially concerning the local conditions and structures. A vote of thanks was tendered the speaker by the chairman.

The regular meeting of the Branch was held on November 16th. Geoffrey Stead, M.E.I.C., district engineer of the Dominion Public Works Department, addressed the meeting on "Richibucto Cape Breakwater". A. G. Tapley, A.M.E.I.C., was in the chair, and a large number of members were present.

Mr. Stead described the general conditions of the northern coast of New Brunswick, its continually shifting sand bars, and the difficult task involved in maintaining harbours which are greatly needed in order that the fishermen may have half a chance to obtain a livelihood. He explained how in a number of cases, and especially at Richibucto cape, which is close to a splendid fishing ground, the improvement of harbours had greatly benefited the fishing industry.

At Richibucto cape no natural harbour existed, and it was necessary to form a sheltered basin within the confines of two piers. Work was started in 1908 and

has continued, at intervals, to date when it is about completed. As the work progressed, the shifting sands filled in, and when the basin was completed it was practically filled to low water with sand. Dredging was resorted to and since then there has been no great difficulty in maintaining a harbour with sufficient depth to protect the shoal draught fishing fleet within its area. Mr. Stead pointed out the lessons learned as the work progressed and the methods adopted in overcoming difficulties which arose. At the conclusion of the paper many interesting questions were asked by the various members.

A vote of thanks to Mr. Stead was moved by H. F. Bennett, A.M.E.I.C., seconded by F. G. Goodspeed, M.E.I.C.

A resolution moved by F. G. Goodspeed, M.E.I.C., and seconded by C. S. Bennett, Jr.E.I.C., was adopted, protesting against the practice of bringing alien engineers into Canada on consulting work, when thoroughly competent Canadians are available.

A resolution endorsing the report of the Remuneration and Classification Committee, as published in the November *Journal*, was adopted.

Hamilton Branch

W. F. McLaren, M.E.I.C., Secretary-Treasurer.

On November 1st, a joint meeting was held with the Hamilton Chapter of the Ontario Society of Architects at the Royal Connaught hotel. Brigadier General C. H. Mitchell, D.S.O., M.E.I.C., Dean of the Faculty of Applied Science, University of Toronto, and Lt.-Col. L. W. Gill, the new principal of the technical school in Hamilton, were guests of the executive at dinner previous to the lecture on Italy.

Brigadier-General Mitchell, who is an old Hamilton boy, was on Lord Cavan's staff in charge of the British Intelligence Department in Italy during the war, and his lecture was illustrated with views from his private collection of slides. The speaker outlined in a comprehensive manner the Italian campaign in the Alps from 1917 to the armistice. The precautions taken by the Italians to preserve their works of art in Venice and other important centers, were dealt with by the speaker, who also described the difficulties encountered by the Italian and British troops in mountain fighting. Engineering problems, such as tunnels, bridges and cliff galleries were discussed with the engineers. At the close of the lecture Stewart McPhie, chairman of the architects, moved a vote of thanks, which was seconded by F. W. Paulin, A.M.E.I.C. of the engineers, and heartily applauded.

The interest shown in the lecture was indicated by the attendance which exceeded one hundred.

London Branch

F. J. Bridges, A.M.E.I.C., Secretary-Treasurer.
R. I. Olmsted, A.M.E.I.C., Branch News Editor.

Regular Meeting, Oct. 18th

A regular meeting of the London Branch was held on the evening of October 18th in the Board Room of the Public Utilities Commission. After the transaction of general business arising from the minutes of the previous meeting the chairman, H. A. Brazier, M.E.I.C., called upon H. B. R. Craig, to tell the members what he knew regarding the Association of Professional Engineers of Ontario. This was followed by a paper, prepared and read by H. A. Brazier, city engineer of London, on the several points of engineering interest in the city, which were inspected by the members of the Branch on the afternoon of October 7th. At the close of this most interesting and well thought out paper, a vote of thanks on motion of Messrs. Angus and Farncomb was unanimously passed and the meeting was adjourned.

Special Meeting

A special meeting of the London Branch was held in the private dining room of the Blue Dragon Tea Room, Dundas St., on Tuesday evening, October 24th, in which dinner was served to some twenty-seven members. K. M. Cameron, M.E.I.C., chairman of the Ottawa Branch and assistant chief engineer of the Department of Public Works of Canada being the guest of honor, H. A. Brazier, M.E.I.C., presiding.

Mr. Cameron, in his address to the members, outlined the Ottawa Branch activities, and explained how their success had been achieved, outlining especially the information which can be obtained by the use of moving picture films available through the Dominion Government Publicity Bureau. Mr. Cameron's address proved most interesting and many points brought out will be of use to the local Branch. At the conclusion of the address a hearty vote of thanks was tendered the speaker.

Lieut. Col. W. J. Brown, executive secretary Western University, London, also Officer Commanding 7th Brigade Canadian Field Artillery, then spoke for a few minutes on the organization of the 7th Field Company, Canadian Engineers, making an appeal to all engineer officers present to assist in this organization which, he stated, had so far proved unsuccessful. The chairman, on behalf of the London Branch, promised Lieut.-Col. Brown the assistance called for, and suggested the appointment of a committee to investigate. This latter point, however, was left to be taken up at an early date.

Cape Breton Branch

Kenneth G. Cameron, A.M.E.I.C., Secretary-Treasurer.

On Tuesday, October 31st, our general secretary, Fraser S. Keith, M.E.I.C., paid a visit to Sydney and was sincerely welcomed by all members. There being no other branches in the near vicinity the visit helped to dispel that feeling of "splendid isolation" which is apt to take possession of us. At 4.30 in the afternoon Mr. Keith addressed a gathering of members in the Dominion Coal Company club house, at Glace Bay, the chairman, C. M. Odell, M.E.I.C., presiding. Mr. Keith's address dealt principally with the recommendations of the Committee on Policy and the steps being taken by Council to put same into effect. Some varying views were expressed during a short discussion on the report of the Committee on Classification and Remuneration, which brought out a few of the difficulties liable to be encountered and drew the attention of members to the necessity of careful consideration of this whole matter. Mr. Keith also outlined the procedure followed in handling *The Institute's*

employment bureau, a matter of great interest to the outlying Branches.

Following the meeting a dinner was held in the same building. Other guests present included W. H. Bischoff, general superintendent of the Dominion Iron and Steel Company and M. A. Doak, comptroller of the British Empire Steel Corporation. In spite of bad weather, members turned out in good numbers, and the evening was voted a success. W. S. Wilson, A.M.E.I.C., was responsible for the entertainment and S. C. Mifflen, A.M.E.I.C., for the arrangements made at Glace Bay and

many thanks are due to them for the energy and time devoted to the meeting.

Submarine Mining

On Tuesday, November 14th, F. W. Gray, A.M.E.I.C., assistant to the vice-president of the British Empire Steel Corporation, addressed the Branch on the above subject, K. H. Marsh, M.E.I.C., vice-chairman of the Branch, presiding.

Mr. Gray's address was similar to one he gave to the Montreal Branch some time ago — a sypnosis of it appearing under the Montreal Branch News in the May 1922, *Journal.* It was a subject of perhaps more vital interest in this locality, and a number of mining men present added to the discussion and brought out many additional matters of interest. W. Herd, mining engineer of the Dominion Coal Company, and A. L. Hay, A.M.E.I.C., assistant mining engineer, described various problems and experiences and Mr. Hay in particular pointed out the necessity of changes being made in the provincial mining laws governing various points of submarine mining. On a motion by Mr. Herd seconded by A. P. Theuerkauf, M.E.I.C., Mr. Gray was tendered a sincere vote of thanks for his address.

Halifax Branch

O. S. Cox, A.M.E.I.C., Secretary-Treasurer.

With an attendance of thirty-two, the first regular Branch meeting of the season was held at the Green Lantern, November 3rd. Chairman F. R. Faulkner presiding. Supper was served at 6.15 p.m., after which the meeting was called to order for transaction of business.

Nominations were called for members to comprise the Nominating Committee and the following were chosen:—H. B. Pickings, A.M.E.I.C., (convener), W. A. Winkfield, M.E.I.C., W. F. McKnight, A.M.E.I.C., Geo. Holmes, S.E.I.C.

The chairman then introduced F. H. Bell, K.C., city solicitor, who gave a very instructive address on "Engineering from the Legal Standpoint". The speaker prefaced his remarks with the statement that many legal difficulties and much litigation may be avoided by the employment of competent legal advice at the beginning of an engineering project or contract rather than by engaging a lawyer only after difficulties have arisen and a lawsuit is pending. Getting a contract into proper shape at the beginning is important, and this can best be done by a properly trained legal mind. The drafting of contracts and specifications often falls to the lot of the engineer, but the speaker advised that the engineer refuse to accept the responsability for the validity of such documents, as this work should be performed by a lawyer, since he is specially trained for the proper execution of such documents. It is advisable in contract drafting to avoid as much as possible the use of legal words and phrases because a wrong or unintentional meaning may be given owing to a lack of appreciation of the full significance of the terms used. Be accurate in description and careful in the choice of words. If long and cumbersome names or titles must be used throughout a specification, insert an interpretation clause, substituting short titles, then be consistent, always using the same word or title when referring to the same subject. Avoid obscurity. Use short simple sentences, paragraphs, sections and sub-sections, and keep together all clauses that deal with the same subject matter. If in a contract draft, specification and schedule are drawn separately the schedule must be deemed part of the contract and attached thereto. Be careful that there is no variation between specification and schedule. Specify how tenders are to be

handed in and give exact date for receiving them. Acceptance of a contract must be unconditional as any added conditions make the acceptance equivalent to a refusal. Any alterations in a contract must be within the contract itself and can only be made with the consent of the guarantor, otherwise the guarantee bond will be released. The clause appearing in most engineering contracts giving the engineer the power to make a final decision in case of disputes is a dangerous one, the courts ruling that this is an arbitration clause and since the engineer is usually employed by one party to the contract he must be partial to his employer, and the moment he shows any partiality he ceases to be an arbitrator, hence the clause does not apply.

Following his paper Mr. Bell answered a number of questions asked by members of the Branch and many interesting points were brought out in the discussion. The appreciative thanks of the Branch were tendered Mr. Bell for his interesting address.

The Branch was fortunate in having Fraser S. Keith, M.E.I.C., general secretary of *The Institute*, as a special guest. He was called on for a few remarks and gave the members an interesting talk on *Institute* affairs. Mr. Keith gave a brief resume of the work and activities of *The Institute* referring especially to the rapid growth in membership during the last few years, the recent progressive changes in policy and to the reports of various special committees. *The Institute* is the only national engineering organization in Canada and can, through the earnest co-operation of its large membership — now over 5,300 — be made the vehicle whereby the profession can be uplifted throughout the Dominion.

After various members had voiced the appreciation of the Branch for Mr. Keith's encouraging remarks, the meeting adjourned at 9.30 p.m.

Moncton Branch

M. J. Murphy, A.M.E.I.C., Secretary-Treasurer.

The Moncton Branch held their regular monthly meeting in the form of an address and luncheon at the Barker House, on Wednesday evening, November 8th. Prof. McKiel, A.M.E.I.C., of Mount Allison University, Sackville, N.B., presided in the absence of the chairman, F. B. Tapley, M.E.I.C. The chairman, after a few pleasing remarks on the activities of *The Institute* in general, introduced Dr. Van A. Clarke, the speaker of the evening.

Dr. Clarke in beginning his address on Radio-Telephony, said that he felt that in speaking to a body of engineers on a subject of this nature, that he was in a sense "Carrying coals to Newcastle", nevertheless he would try to do the very best he could with the subject. Dr. Clarke then described in general the history of radio from its infancy and followed and explained its development up to the present. Each improvement made was explained and the technicalities of the radio receiving set were pointed out by sketches on a black board. The speaker seemed to be thoroughly at home on the subject, and from his remarks has spent a great deal of time and study on the subject.

Fraser S. Keith, M.E.I.C., general secretary of *The Institute,* who is on a visit to all the different branches in the Maritime Provinces, spoke on matters pertaining to *The Institute* in general. He told of the work that had been done by *The Institute* in the past and what was proposed to be done in the future. In speaking of the organization as a whole, he mentioned the fact that in the republic to the south there was a great number of engineering societies, while in Canada all engineers were embraced under one, which he felt was an advantage in many ways.

A. E. McNutt of Moncton, who was kind enough to set up his radio receiving set in the dining room, gave a very enjoyable concert. From Newark part of a musical concert was heard perfectly; from Arlington the time signals were taken; while Cambridge also was heard. During the first part of the evening the transmission was very clear, but owing to a sudden change in the weather, interference which could not be overcome caused considerable breaks in the concert.

A very pleasing part of the evening's entertainment was the vocal solo numbers by Mr. Alonzo Johnson, who sang in splendid voice and manner "Only In Dreams", (from the Knukerbreken Opera), and for an encore, "The Longshoreman".

Border Cities Branch

J. Clark Keith, A.M.E.I.C., Secretary-Treasurer.

On Saturday, October 14th, members of the Border Cities Branch and their friends were the guests of the officials of the Canadian Steel Corporation at Ojibway. Met by W. H. Baltzell, M.E.I.C., at the office of the company, they were given such refreshments as may be obtained in a dry country. Before proceeding to the works under construction, the plant layout was explained from maps in the office. A tour was then made of the property, including the blast furnaces from which an excellent view of the surrounding country could be obtained, the wire mill and the machine shop, not omitting the police dogs of two generations. Detailed information was supplied by Mr. Baltzell and by officials of the Canadian Bridge Company who were familiar with the structural design. The entire afternoon of a delightful autumn day was spent in a most interesting manner and the keenest interest was displayed by the forty or more members who were present.

The regular meeting of the Border Cities Branch was held in the Prince Edward hotel on Friday, November 10th, at 7 p.m., at which twenty-two members were present. The customary dinner feature preceeded the business and address of the evening.

The chairman made a brief reference to the meeting in December and to the election of officers at that meeting. It was very desirable to have every member present at that meeting and the question was raised as to where this meeting should be held. It was moved by A. J. Riddell, A.M.E.I.C., and seconded by E. F. Considine, M.E.I.C., that the annual meeting be held in the Prince Edward hotel.

M. E. Brian, A.M.E.I.C., city engineer of Windsor, entertained the gathering with his "Reminiscences of a City Engineer". Mr. Brian expressed the thought that "Reminiscences" were hardly appropriate as that word could usually be associated with hardening of the arteries

and that he would have to live as long again before such a condition might be found. As far as he knew he was the only one present who had been born in Windsor and from the day when he had his first glimpse of Windsor to the present time he had seen the place grow from a straggling town of 3,000 to the rapidly growing city of 42,000, that it is to-day. His school mates, who had for the most part gone into business, chose more lucrative fields than he had done, but he loved the engineering game. Wm. Newman, the city engineer of Windsor in those earlier days, received $6.00 per day when he worked. Victoria avenue, the principal residential street of Windsor to-day, was then all bush and Tecumseh road was a place where nuts abounded. There were then no sewers west of Bruce avenue nor east of Parent avenue. When he became city engineer, twelve years ago at $1,600 per year, there were no houses south of Wyandotte street. Humorous anecdotes were interspersed throughout in his inimitable Irish manner.

Mr. Brian gave in detail the work which was involved in the construction of each local improvement and the various methods by which it could be undertaken. *He abjured engineers to stop the criticism of their fellow engineers, but rather to boost them and place them on a par with the professions of law and medicine.* A tribute was paid to the earlier engineers of the district in their vision and foresight in laying the first sewers which were still adequate for the city's needs. His memories of municipal work were most pleasant and his work could not have been carried out without the co-operation of council, the public and the press. Everybody made mistakes, no one knew it better than he did but when such things happen to your fellow engineers "chide him in secret not openly".

The operation of the civic asphalt plant was explained in detail. The Windsor plant has a capacity of 1,800 yards of 2 inch compression in 9 hours. Eight hundred yards a day was considered a good average but they had had one run of 8,085 yards in seven days. Mr. Brian promised later to give operating costs to the Branch when they had been tabulated.

Following the address, ways and means were discussed for increasing the attendance of meetings. G. F. Porter, M.E.I.C., thought that engineers do not receive the recognition or the remuneration they deserve because they do not associate more along fraternal lines, developing the art of expressing themselves and selling their services to the public. Many members had transferred to the Border Cities Branch who did not attend the meetings. The meetings are for the younger men, the older men are in more permanent positions and do not stand to gain as much as those just starting out in life.

The regular meetings of the Border Cities Branch were resumed on October 13th, when thirty-nine members and prospective members gathered at the Prince Edward hotel for dinner.

W. H. Baltzell, M.E.I.C., chief engineer of the Canadian Steel Company, extended an invitation to all present to inspect the property and the construction now being carried on at Ojibway. The invitation was most heartily accepted and arrangements were made to gather there on Saturday, the 21st, at 2.30 p.m.

G. F. Porter, M.E.I.C., made a brief reference to the General professional meeting held in Winnipeg early in September. Very interesting papers were presented dealing with hydraulic questions and the effects of alkali on concrete. The spirit of brotherhood appeared to prevail throughout the entire gathering and their hospitality was so abundant that even the engineers weakened under a succession of laden tables.

C. E. Goodrich, M.E.I.C., of the Canadian Bridge Company, then gave a most interesting address on "The Design of Transmission Towers". The transmission tower field is a highly specialized field. So is any field that deals with large tonnages and low prices; and as large tonnages mean small percentages of profit, transmission tower work has come to be the product of special equipment and such methods as make low prices possible. The manufacturer should have a small fabricating shop used for nothing else, where all the machinery is especially planned for very light work, and incidentally is unsuited for the most economical work even on the average roof truss.

The paper was so interspersed by the speaker with humorous personal reminiscenses that his listeners were presented with the features of a highly technical subject in a very matter of fact way and it was much appreciated by all present.

Ottawa Branch

F. C. C. Lynch, Associate E.I.C., Secretary-Treasurer.

A brilliant and enthusing address on the subject of the "Great Lakes - St. Lawrence Scheme" was delivered by Hon. J. A. O. Preus, governor of the state of Minnesota, at a luncheon held on November 15th, at the Chateau Laurier, by the Ottawa Branch. A large and distinguished audience was present, including the Prime Minister, the Leader of the Opposition, Cabinet Ministers and Government officials, the Premiers of four provinces, Government representatives of various provinces, the United States Consul General and several Minnesota State officials, as well as many prominent engineers. It was probably the largest luncheon ever held by the Ottawa Branch, the main dining room of the Chateau being filled for the occasion.

"Your views and mine may differ somewhat at times, but need knows no law," declared Mr. Preus. We need the waterways very badly. "Minnesota is the wealthiest state in the Union," he continued. "Not only was the state a leader in agriculture, but it also produced much iron. Minnesota being the largest producer of iron in the United States. One mine alone was valued at more than the whole amount mentioned by the Reparations Commission as the value of the iron of Alsace-Lorraine. Agriculture was the basic industry of Minnesota, however, and butter was a leading product." Mr. Preus mentioned these facts, he pointed out, because the products of the state would come down the proposed waterway. "It was also a fact that the impetus for the water route had been started in the state of Minnesota. It cost too much money to ship a carload lot by rail all the way from New York. New York city was farther from Liverpool than Buffalo by about 500 miles. With the all-water route there would be a saving of at least five cents per bushel in the shipping rate, according to an expert's

advice, and part of this saving would go to the consumer and part to the farmer."

Mr. Preus referred to the great population of eighteen states from the Allegheny mountains to the Rockies as having a bearing on the situation. To ship a ton of iron from Duluth to Boston cost $22.77 by rail and $5.55 by water. Under present conditions Argentine was a strong competitor with the best of the wheat states, such as Kansas and Nebraska.

"The extent of the improvement necessary in the Great Lakes-St. Lawrence River scheme to provide the waterway, including the building of locks for 34 miles where the water is shallow and the channel will have to be improved for 182 miles. This will cost $252,000,000. A few years ago, we built the Panama canal and that is of no use to the middle west. The Panama canal cost $400,000,000. Ten times the tonnage passes through the Soo canal in the open season as goes through the Panama canal in the whole year."

"Four million one hundred thousand water horse-power can be developed in the waterways scheme, and, out of that, 3,100,000 horse power will go to Canada. We are all interested in the proposition even in that light. Some objectors in New York say we should not spend money for any project outside of the States. That attitude is silly. We built the Panama canal and that is not on American soil. My view is that Canada is not foreign soil to the United States. People who speak the same tongue and have the same ideals can never have a disagreement that would lead to the taking up of arms."

Mr. Preus declared that any word spoken in the United States Senate against Canada would not be received kindly by many of the Senators themselves. The position of the United States was like that of a son who had left home when young. There was always a sincere regard for England, the old home.

In introducing the speaker, Mr. K. M. Cameron congratulated Mr. Preus on his recent re-election to the Governorship of Minnesota, which, he felt, was an endorsement of the policy established by him. Governor Preus is one of the most highly regarded figures in American State politics. His father went to the United States from Norway more than 50 years ago, and was one of the pioneers in the work of the Norwegian Lutheran church in the north western States. Mr. Preus was educated in public schools and graduated from Luther College at Decorah, Iowa. He has been successively Insurance Commissioner, State Auditor and Governor of his state, although still quite young in years. In 1920 Governor Preus headed a vigourous drive against socialism and red propaganda, the disturbing element having sought to secure dominance in Minnesota after obtaining a grip in North Dakota. They brought out a strong candidate for Governor, but Mr. Preus conducted such a stern campaign that he routed the opposition. Governor Preus is a public speaker of rare ability, and he delighted the large audience at the Chateau Laurier with his forceful address.

K. M. Cameron, M.E.I.C., presided, and with him at the head table were: Rt. Hon. W. L. Mackenzie King, Prime Minister; Rt. Hon. Arthur Meighen; Hon. Chas. Stewart, Minister of Interior; Hon. Dr. J. H. King, Minister of Public Works; Hon. E. C. Drury, Premier of Ontario; Hon. John Bracken, Premier of Manitoba; Hon. A. C. Dunning, Premier of Saskatchewan; Hon. H. Greenfield, Premier of Alberta; Hon. T. H. Johnson, ex.-attorney general of Manitoba; Hon. J. E. Brownlee, attorney general of Alberta; Hon. R. W. Craig, attorney general of Manitoba; Hon. J. G. Foster, United States Consul General; Hon. M. Hilton, attorney general of Minnesota; A. F. Pratt, assistant attorney general of Minnesota; E. H. Hussey, chief engineer, Minnesota and Ontario Power Company; J. Jewell; E. W. Backus, president of the Backus-Brooks Company, of Minneapolis; J. B. Hunter, Deputy Minister of Public Works; L. V. Rorke, director of Surveys for Ontario; G. P. Mackenzie, gold commissioner for Yukon; Fraser S. Keith, M.E.I.C., secretary, *Engineering Institute of Canada;* H. G. Acres, M.E.I.C., vice-president, *Engineering Institute of Canada;* Dr. J. G. Rutherford, Board of Railway Commissioners; A. St. Laurent, M.E.I.C., chief engineer, Department of Public Works; C. A. Magrath, M.E.I.C., chairman, International Joint Commission; Geo. A. Mountain, M.E.I.C., chief engineer, Board of Railway Commissioners; and Lieut.-Col. W. P. Anderson, M.E.I.C., past president of *The Engineering Institute of Canada.*

Branch Honours Dr. Deville, Hon. M.E.I.C.

Edouard G. Deville, LL.D., D.T.S., HON. M.E.I.C., director general of Surveys in the Department of the Interior, Ottawa, was the guest of honour at a luncheon held on October 31st, at the Chateau Laurier, by the Ottawa Branch, as a mark of esteem on the occasion of his election as an Honorary Member of *The Institute.* There was a large attendance of the members of the Ottawa Branch and others prominent in engineering and scientific research. K. M. Cameron, M.E.I.C., presided, and with him at the head table were: C. A. Magrath, M.E.I.C., chairman, International Joint Commission; T. Shanks, M.E.I.C., acting surveyor general, Department of the Interior; R. A. Gibson, assistant deputy minister, Department of the Interior; J. E. Featherston, private secretary to the Minister of the Interior; N. J. Ogilvie, M.E.I.C., superintendent of Geodetic Survey of Canada; G. B. Dodge, M.E.I.C., special surveys engineer, Topographical Surveys Branch; O. S. Finnie, M.E.I.C., director, Northwest Territories Branch; E. W. Hubbell, chief inspector of surveys; Dr. Charles Camsell, deputy minister of Mines; Dr. W. Bell Dawson, M.E.I.C., superintendent of Tidal Surveys; A. St. Laurent, M.E.I.C., chief engineer, Department of Public Works; J. J. McArthur, M.E.I.C., International Boundary Commissioner; C. H. Keefer, M.E.I.C.; J. M. Roberts, secretary, Department of the Interior; and J. B. Challies, M.E.I.C., director, Dominion Water Power Branch.

Mr. Cameron spoke of the esteem and honour in which Dr. Deville was held. He had not only brought renown to the Ottawa Branch in his great work, but had brought recognition to the engineering profession in Canada and placed it on a par with the foremost in the world. Through his promotion, he had taken his place in company which was the lot of few to associate with, and he had been in every way worthy of the honour; in fact if there had been any higher honour conferrable, it would have probably been extended to him.

Charles A. Magrath, in a few words of tribute to Dr. Deville, referred to the early recognition of his ability, by being commissioned to represent Canada on many International Committees in all parts of the world where Canadian scientific interests were in the limelight.

Thomas Shanks spoke of the appreciation and esteem ıeld for him in the branch of the department of which ıe had charge. The development of the Canadian West ıad commenced in earnest with the appointment of Dr. Deville to the office of Surveyor-General, and he ıad kepth is work abreast and ahead of the development, so that to-day Canada had the most perfect system of Dominion Lands Survey, with particular reference to the western provinces that any country in the world could boast. The perfecting of this system was in the main lue to the efforts and genius of Dr. Deville. Mr. Shanks hen presented Dr. Deville with a gold badge of member-hip in *The Institute*.

E. DEVILLE, LL.D., D.L.S., F.R.S.C., Hon. M.E.I.C.

Dr. Deville in replying expressed himself as deeply ouched by the tributes which had been paid to him by he various speakers. Of all the honours which might ave been his, had he been able to qualify for any others, he one he valued most was the one which had just been onferred on him. He gave a most comprehensive account f the work of the Dominion Lands Survey, over which e had the honour of being chief, and related amusing necdotes of his experiences with Sir John A. Macdonald uring his term of office as Premier, arising out of Sir ohn's pronounced antipathy for anything pertaining to ngineering, surveying or science. At all times he treated ıe men of the department with contempt, and exacted f them the utmost efficiency, which in Dr. Deville's pinion was probably the secret of the efficiency of the epartment to-day.

Dr. Deville began his brilliant career as an officer ı the French navy, when he was in charge of extensive hydrographic surveys in the South Sea Islands, Peru and other countries. Resigning a naval career in 1874 he came to Canada and after valuable service rendered to the province of Quebec in connection with provincial surveys, he joined the staff of the Surveys Branch of the Dominion Government. His initiative and ability soon brought him to the front. When Lindsay Russell resigned from the position of surveyor general, Dr. Deville was called upon to succeed him. This position he held until early in the present year when he was made director general of surveys and was placed in charge of the surveying branches of the Department of the Interior comprising topographical surveys, geodetic surveys and international boundary surveys. Besides being the author of various text books that are highly valued by his profession, such as "Astronomic and Geodetic Calculations" and "Photographic Surveying", Dr. Deville has contributed numerous scientific papers, notably to the Royal Society of Canada, of which he is a charter member, and of which he was for many years since its formation, secretary of the mathematical section. In the realm of photographic surveying he is universally recognized as one of the world's authorities, and it is worthy of note that in the recent Mount Everest expedition, photographic surveys were made with a camera copied from those designed by Dr. Deville for use on Canadian surveys. The University of Toronto in 1905 paid a tribute to his service to the cause of science when they conferred upon him the honorary degree of Doctor of Laws, while in 1916 His Majesty the King rewarded his faithful work by appointing him a Companion of the Imperial Service Order, as a recognition of the sterling services he has rendered to Canada and to the Empire by his researches. Last May he was further honoured by being appointed to represent Canada at the meetings of the International Union of Geodesy and Geophysics held at Rome, when no less than twenty allied countries were represented.

Although he has given the greater portion of his energies to scientific research and to the perfecting of the Dominion Lands Surveys system, the efficiency of which to-day is such a tribute to his remarkable initiative and ability, yet he can still find time for other activities, particularly in the interests of St. Luke's Hospital, Ottawa, of which institution he has been a Governor since its inauguration in 1898. He is also a Governor of the "Alliance Française". In addition to these, a list of Dr. Deville's activities includes: office of chairman of the Dominion Board of Topographical Surveys and Maps, chairman of the Board of Examiners for Dominion Land Surveyors, chairman of the Geographic Board of Canada, member of Canadian Engineering Standards Association, member of the Ottawa Municipal Hospital Commission, member of the Air Board of Canada, Patron of the Town Planning Institute of Canada, Patron of the Dominion Land Surveyors' Association.

In taking his place among the Honorary Members of *The Engineering Institute of Canada*, Dr. Deville will be in distinguished company. Previous to his election, there were only ten living members on the list. Among these are H.R.H. The Prince of Wales, H.R.H. The Duke of Connaught, The Duke of Devonshire, The Earl of Aberdeen and General Lord Byng of Vimy, the present Governor General of Canada.

Lethbridge Branch

G. S. Brown, A.M.E.I.C., Secretary-Treasurer.

On October 7th, Colonel H. C. Boyden, of the Portland Cement Association, Chicago, addressed a special meeting of the Lethbridge Branch, the subject being "Concrete Highway Investigations and Specifications". Following the address there was an interesting discussion which lasted late into the evening.

Work in the Punjab

A. M. Robertson, executive engineer of the Punjab, India, addressed a special meeting of the Branch on Friday, November 10th. A brief outline was given, covering the construction and operation problems which were encountered in the Punjab. Coolie labour has been chiefly employed in the past years, but owing to its higher cost at the present time, the reclamation work is in a transition stage and modern machinery is being introduced. The Punjab, through irrigation, has become a highly productive part of India. Ten and one-half million acres of land are being served with water by five rivers, Jhelan, Chenab, Raire, Beas and Sutlej. (The meaning of Punjab is "The Land of the Five Rivers.") Two crops, cotton and wheat, are raised annually. Irrigation systems in the Punjab are government owned, the investment giving a net return of eleven and one-half per cent. The most recent scheme is the Sutley Valley project, comprising five million acres. This will represent an expenditure of £8,000,000, and is expected to give a return of thirty-five per cent. Mr. Robertson is in America studying irrigation construction methods, and while in Lethbridge, was shown over the C.P.R., and the Lethbridge Northern Irrigation districts. He expressed admiration for the irrigation systems in Alberta.

C. M. Arnold, M.E.I.C., on behalf of the Branch, extended a hearty vote of thanks to the speaker of the evening.

These two Branches meetings were each preceeded by the usual dinner and social time.

Edmonton Branch

R. H. Douglas, A.M.E.I.C., Secretary-Treasurer.

With an attendance of fifty, a very successful meeting of the Edmonton Branch was held in the Edmonton Board of Trade rooms on Wednesday, November 15th, at 8 p.m., Col. J. G. Reid, M.E.I.C., being in the chair. Three excellent fifteen-minute papers were given, each one being followed by a fifteen-minute discussion.

R. W. Ross, A.M.E.I.C., gave a paper on railroad organization, pointing out in a very clear manner the various duties of the superior officers in the organization. By the use of a chart the working of the organization was traced from the president through all the various officers down to the common laborer.

R. B. Baxter, superintendent of the Alberta Government telephones, gave a very interesting address on telephony, tracing the growth and advancements made since its inception some forty-seven years ago. Mr. Baxter described how, by the use of apparatus known as repeaters, the talking range was practically unlimited. Mr. Baxter stated that the longest known conversation made as a test was some 10,000 miles. Mr. Baxter discussed the possibilities of the radio phone replacing the telephone in commercial use, but stated that in its present form it could not be satisfactorily used owing to the fact that conversations could be heard by anyone tuneing-in their instruments with the instrument being used.

A. E. Cameron, of the University of Alberta, in his paper went into the commercial possibilities of smelting iron ores from the vicinity of Athabaska lake. Mr. Cameron stated that for the production of pig iron from ore, two other materials, fuel (coke) and flux (limestone) are required. Limestone for fluxing purposes could probably be obtained from Devonian limestones outcropping on Athabaska river, but the nearest coal deposits suitable for the manufacture of metallurgical coke occur in the Jasper Park district of Alberta, about 600 miles from Athabaska lake. With regard to the possible position of a smelter for these iron ores, the advantages and disadvantages of different locations were outlined, and a location at Waterways assumed. Making the assumption that transportation rates on materials to, and products from, the smelter would be about the same as existing transportation rates on coal throughout the Prairie Provinces, it was next shown that under exceedingly favourable conditions, including an operating extension of the Alberta and Great Western Railway from Waterways to Athabaska Lake, good grades of ores from Athabaska lake could be smelted and resultant pig iron placed upon the Edmonton market at about $35.00 a ton. Market conditions for this product were then gone into and it was shown that the cost of long rail hauls would prohibit any extensive development of an export market while the market for pig iron in the province of Alberta would clearly not warrant the production of pig iron even under the extremely favourable conditions assumed.

Kingston Branch

L. T. Rutledge, M.E.I.C., Secretary-Treasurer.

The opening meeting of the Branch for the session 1922-23 was held on October 10th. On this occasion part of the regular business of the annual meeting was transacted. The annual meeting, however, was held officially on October 25th.

The secretary's annual report was received. His financial report showed the financial condition of the Branch to be satisfactory, the cash credit balance having been considerably increased during the year. A few new corporate members had been added and but very few old ones having been lost through transfers, so that the membership showed a net increase. In addition approximately ninety students members had been enrolled during the past year.

Within the past twelve months, the executive had formulated a set of by-laws which were approved by Council in February, 1922, and shortly afterwards adopted by the Branch.

The secretary thanked the officers and members of committees for their loyal co-operation and assistance during the year. The success of the Branch was due entirely to the general interest shown by officers and members of every grade.

The report of the Programme and Entertainment Committee was presented by R. J. McClelland, A.M.E.I.C., the convenor of the committee. Twelve regular meetings were held during the year and excellent papers were given. In the lectures and addresses, the committee had endeavoured to enhance the interest of the public and the university towards the profession. The meetings were well attended during the session and many indications were evident that interest in the Branch had been gradually growing.

The chairman, Professor W. P. Wilgar, in a general way reviewed the activities of the Branch. He congratulated the Branch on the honour shown one of its members, namely, Dean Clark, Dean of the Faculty of Science, Queen's University, who had recently been elected an Honorary Member of *The Engineering Institute of Canada*. Dr. Clark has been closely associated with engineering for the past eighteen years. He has been more closely associated with engineering research and scientific engineering, than with field engineering. The Branch is, indeed, very grateful to the Council for the honour bestowed on Dr. Clark.

Election of officers for the year 1922-23 was held and the following were declared elected.

Chairman	L. M. Arkley, M.E.I.C.
Vice-Chairman	T. A. McGinnis, A.M.E.I.C.
Secretary-Treasurer	L. T. Rutledge, M.E.I.C.
Executive	L. M. Arkley, M.E.I.C., T. McGinnis, A.M.E.I.C., L. T. Rutledge, M.E.I.C., Col. T. Anderson, A.M.E.I.C., W. L. Malcolm, M.E.I.C., G. S. Smith, A.M.E.I.C.
Programme Committee	D. S. Ellis, A.M.E.I.C., (convenor) Major G. Turner, A.M.E.I.C., Major L. Grant, A.M.E.I.C., D. Jemmett, A.M.E.I.C., A. Jackson, A.M.E.I.C.

On the business of the annual meeting being concluded, Professor Wilgar retired from the chair, which was then taken by Professor L. M. Arkley, the chairman-elect. Professor Arkley thanked the Branch for the honour done him in electing him unanimously to this important position, an honour that every member should strive to attain. He emphasized the point that each member should be an active one and endeavour to hold at some time or other an office in the Branch, so as to become more closely associated with *The Institute* and become more interested in its welfare. He concluded his remarks by an assurance that the officers would put forth every effort to make the coming year as successful, if not more so, as the one just concluded.

The address of the evening was given by Professor Alexander Macphail, D.S.O., professor of general engineering in Queen's University. He chose as his subject one somewhat philosophical in nature. The address was entitled "Observations and Reflections". The observations were made during his recent travels abroad in the Near East. The reflections were made during those travels and ever since. He analyzed at considerable length the society, environments and conditions effecting the life and aspirations of the dark-skinned races of the East. The address had a humorous tone to it and was intensely interesting. A hearty vote of thanks was tendered Professor Macphail.

The next regular meeting of the Branch was held on November 14th, at which meeting G. S. Monture, B.SC., manager of the Employment Bureau of Queen's University, gave an address entitled "Evolution of Prices and Wages". The paper was suggested by the epoch-making rise in wages and prices which had been caused by the World War. The speaker inferred that the only correct way to study the present conditions was to review the revolutions in standard wages and prices that have taken place in the past. Then one might be able to judge whether the present abnormal conditions will be temporary or permanent, and if only temporary, how long they may be expected to continue. Accordingly price levels were studied almost from the dawn of history, and with the aid of graphs the speaker made it quite apparent to the audience that labour conditions are improving gradually.

A hearty vote of thanks was tendered Mr. Monture for his very interesting paper.

Winnipeg Branch

George L. Guy, M.E.I.C., Secretary-Treasurer.

At the October meeting of the Winnipeg Branch at which the chairman of the Branch, C. V. Caton, M.E.I.C., presided, a very interesting address on concrete highway investigations and specifications was given by Lt.-Col. H. C. Boyden.

The speaker stated that the United States has now 262 million square yards of concrete road of which 187 million, or about 71½ per cent has been built during the last five years. Canada has 6 million square yards, of which 54.2 per cent has been built during the last five years. Of the total yardage in the United States 52½ per cent is in twelve states lying north and east of the state of Missouri, which is considered to be ample evidence that a concrete surfaced road is adaptable to a cold climate. The speaker further said that it was impossible to obtain the cost of all the roads constructed but assuming, as an average, that the cost was $2.50 per square yard, the total investment in the United States must be $655,000,000, and in Canada $15,000,000. In 1921, $160,000,000, or 24.4 per cent of the total was invested and it is at present indicated that the investment in 1922 will amount to $240,000,000. The salient facts shown by these figures are: — The enormous growth during the last few years in the use of concrete road surfaces. The satisfaction which such a surface evidently affords, and the resulting enormous investment. That of greatest interest to the engineer is the enormous investment and the necessity of safeguarding this is obvious and may be accomplished in two ways; by permanent construction, and by adequate maintenance. While maintenance is essential for any type of road, there can be no doubt that an investment such as this can be best protected by permanent construction in the first instance. It becomes necessary therefore, in view of the large sums of money, which have been and are about to be spent in the construction of roads to make exhaustive search for the purpose of establishing what is the most permanent type of construction.

The speaker referred to the many investigations in the nature of observations of the effect of ordinary traffic on certain selected sections of recently constructed highways, which are being made at widely separated points

and under widely different conditions. The United States Federal Government has recently established an advisory board for the purpose of collecting, collating and co-ordinating the results of all these tests, the most valuable series of which are those being carried out on specially constructed sections of road under controlled and known traffic.

As a result of his observations of these tests, Colonel Boyden stated, he had made the following recommendations:—

The recommendations regarding sud-grades might be summarized as follows:

(1) Soil studies should be made long in advance of construction.
(2) Every precaution should be taken to insure a uniform sub-grade.
(3) The design of the slab should be varied to suit the bearing power of the soil.
(4) The preparation of a sub-grade ought to be a separate item in the contract.
(5) The ditches should be so designed as to carry the water away quickly.
(6) A close study of their economies should be undertaken before deciding to put down tile drains.
(7) Gumbo soil should be pulverized and recompacted for a depth of eighteen inches to twenty-four inches.
(8) Pervious sub-grades should be sealed before laying concrete
(9) Old roads should be scarified.

Summary of chief recommendations appertaining tc concrete slabs:—

(1) For one-way traffic the minimum width of pavement should not be less than ten feet — for two ways twenty feet — for three ways thirty feet, and so on.
(2) In grading, allowances should be made for shoulders not less than five feet wide.
(3) The shoulder should not be gravelled.
(4) Concrete surfacing less than six inches thick should not be built under any circumstances.
(5) Concrete surfaces six inches thick should be restricted to traffic not exceeding two tons.
(6) The minimum thickness for any heavier loading should be eight inches.
(7) Study should be made as to the economy of increasing the width where the sub-grade is poor.
(8) The Arizona section a six inch pavement nine inch at the sides for a width of two feet seems to offer certain advantages.
(9) Expansion joints should be put in at all changes in alignment and grade, at one hundred foot intervals in a reinforced concrete slab and fifty foot intervals in a plain concrete slab.
(10) All joints should have three-quarter inch dowels six feet long and not more than five foot intervals, one half of the dowel to be oiled to permit expansion.
(11) A longitudinal centre joint is an advantage but if used should have a two-inch radius semi-circular key.
(12) Reinforcement does not increase the strength of the concrete slab.
(13) If reinforcement is used it should be at the rate of sixty pounds per hundred square feet.
(14) Reinforcement should be either in the centre or two inches from the top of the slab.
(15) Longitudinal reinforcement, consisting of three and a half inches round rods in the centre of the slab, should be used on all edges.
(16) Care should be taken to insure a perfectly smooth surface; a ten foot straight edge placed anywhere should show no appreciable deviation.
(17) All joints and cracks which may develop should be carefully inspected and continuously maintained.

Recommendations regarding mixing and proportioning concrete:—

(1) The ideal mixer is one on which there is provision for measuring accurately and automatically the ingredients, and which once having started to rotate a batch cannot be dumped until the batch is completely mixed.
(2) It would appear as a result of recent tests that the strength of concrete increases very rapidly from the time of mixing up to one minute and a half, therefore this is the minimum time any one batch should be mixed.
(3) All concrete road surface, where practicable, should be ponded for a period of three weeks after being poured. If it is not possible to supply sufficient water for the surface it should be covered with moist earth for a similar period

At the close of his address Colonel Boyden showec a number of lantern slides illustrating the tests being carried out on the Bates and Arizona roads and also the construction of a concrete pavement on a new hydraulic fill in the city of Chicago. An interesting discussion followed in which a considerable number of the members took part

Calgary Branch

J. A. Spreckley, A.M.E.I.C., Secretary.
Lloyd R. Beach, A.M.E.I.C., Branch News Editor.

"Irrigation in the Punjab" was the subject of a tall given before the Calgary Branch on November 3rd, b A. N. McI. Robertson, M.I.C.E., who is an executiv engineer in India, travelling in western Canada to observ irrigation practice here. Mr. Robertson spoke from ver brief notes for over an hour and then answered question for as long a time. Describing conditions in the Punjab the speaker said that labour is cheap but machinery i very expensive, while for construction purposes, rock fo masonary is usually available within one hundred miles c the works. Cement, which until recent years was im ported from England, is not economically available fc engineering works, and wood is very little used. Bric is manufactured locally at a low cost and in the absenc of clean sand, pulverized brick, known locally as "Surkhi is used for mortar.

With a rainfall varying from three to four inches i the lower plains to twenty-five to thirty inches in th foothills, the rivers from which the water supply drawn, have a range in stage from 3,000 second-feet t 70,000 second-feet and occasionally as high as 600,0C second-feet during summer floods.

Irrigation has been practised for a great many yea by since the advent of the British to India large cana have been constructed in the Punjab and settlement irrigated lands has been very successful. When well estal lished these yield a net profit up to 11¼ per cent. Tl total irrigated area in the Punjab is about ten and on half million acres.

Stone masonary in lime or hydraulic lime mort forms is used for the bulk of the headworks. These headworl usually simply a weir, up to a mile in length, wi iron shutters on the crests so arranged that when a floc comes, one shutter is dropped by hand and the rest f automatically one after the other. While easy to dro much labour is necessary to replace them upright. Tl newer designs are calling for Stoney gates. Manipulatic of undersluices is necessary to avoid silt bars from formir in front of canal intakes, and it is only by practice th successful means have been found for accomplishing th

It is no part of the plan to dredge silt from cana Instead silt is kept moving all the time until water reach the land. Kennedy's hydraulic tables are consider

invaluable in designing canals to accomplish this. Moreover, canals are never as a rule run part full. They are run full or not at all. If water is not available to run them full, rotation in use of distributaries is resorted to. Some sort of module to limit the supply to each user is considered necessary. The Harvey and Stoddart module is the newest type, details of which may be secured from Messrs. G. Kent and Company, Luton, England, the manufacturers.

It is anticipated that an irrigation scheme at a cost of about £8,000,000 will shortly be operated on a new tract of about 5,000,000 acres. This work is now in progress.

Proportional Representation

Although the system of proportional representation is now very generally adopted in elections, the underlying principles are little understood by the general public and P. Turner Bone, M.E.I.C., is to be congratulated on the very lucid explanation which he gave to the Calgary Branch on Tuesday evening November 7th, at the Board of Trade rooms. In order to appeal to the graphic instincts of engineers Mr. Bone had prepared five charts to illustrate the subject and traced the history of the system from the Presbyterian method of holding a series of elections to secure a majority for one candidate, by a process of elimination. Those present who were not familiar with the specific advantages of the scientific compilation of election results were very much impressed by the clear statement of the facts as applied to a few simplified cases and in thanking Mr. Bone for his address the chairman, P. J. Jennings, M.E.I.C., expressed his astonishment at the speed and accuracy with which it was possible to determine the results at municipal and other elections where many thousands of votes were involved. It was evident that the lecturer had given the whole subject very close study and the interest of the meeting was evinced by the large number of questions of detail taken up in the discussion.

Toronto Branch

O. M. Falls, A.M.E.I.C., Secretary-Treasurer.

The weekly meetings of the Toronto Branch since the opening of the fall session have been very well attended. At all meetings both interesting and profitable discussions have been developed, and the executive, having a formidable array of talent reserved for the coming meetings, feel confident that the membership will show their approval by their continued regular attendance.

Town Planning Legislation.

The meeting of October 26th was taken up with a discussion of the proposed town planning bill as prepared by a committee of the Town Planning and Housing Association, and which is to come before the next session of the legislature for consideration. Arrangements for the evening were in the hands of Norman D. Wilson, A.M.E.I.C., of the Toronto Harbour Commission who, in introducing the subject defined town planning as "community foresight". He gave as the main objectives of the bill the establishment of provincial supervision, of adequate machinery to aid the development of suburban areas in the mutual interests of both suburb and city, and the retaining of the Ontario Railway Board as a court of appeal for all parties.

The functions of the Central Bureau of Town Planning and the Town Planning District Commission were very ably presented by W. S. B. Armstrong, secretary of the Ontario Town Planning and Housing Association. Mr. Armstrong instanced the resemblance between the duties of the central bureau and the local government boards as constituted in Great Britain.

R. Redman, solicitor for the township of Scarboro, presented the case of a township lying partly within the suburban area of a growing city and out of a vast fund of experience in municipal matters touched on many problems of vital importance which the proposed act sought to correct.

In the discussion which followed, G. G. Powell, M.E.I.C., deputy city engineer of Toronto, and James Govan, provincial architect, spoke briefly. T. D. leMay, city surveyor, also answered many criticisms of the bill and explained the purpose and limitations of several sections relating to the powers to be invested in the proposed commissions.

Light Alloys in Structural Engineering Practice.

The Toronto Branch listened to a very interesting address on November 2nd by Professor O. W. Ellis, A.M.E.I.C., of the department of metallurgical engineering, University of Toronto, on the subject of the use of light alloys in structural engineering practice. Professor Ellis is a recent addition to the staff of the university and if we may judge from the interest aroused in his initial lecture to the Branch his talent will be eagerly sought after in the future. This paper is published elsewhere in this issue of *The Journal.*

Students Night.

The evening of November 9th was reserved for students night and a large attendance of the undergraduates of the Faculty of Applied Science taxed to the limit the seating capacity of the lecture room at the Engineers Club. The speakers of the evening were all students of this year's graduating class of the University and the manner in which they presented their various subject was highly commendable to the staff of the institution which they are attending.

F. A. Ellis, S.E.I.C., spoke on the subject of "Power Factor" as applied more particularly to the induction motor. After deriving an expression for its determination in terms of electrical units, he dwelt upon its practical importance in the economic use of power. Mr. Ellis is graduating in the electrical department and was during vacation periods employed by the Toronto Hydro Commission on station maintenance, office and test work.

D. B. Strudley, S.E.I.C., dealt with the subject of "Manufacturing Cost Accounting" with particular attention to factory overhead. Various methods of cost accounting were outlined and suggestions offered to ensure proper distribution of overhead charges. Mr. Strudley is specializing during his final year in thermodynamics and hydraulics and has been during his vacation periods employed by the Imperial Rattan Company, Stratford.

The concluding speaker was H. F. Robertson, S.E.I.C., who spoke on "Refractory Materials". He exhibited samples of various refractory products and explained the significance of the test to which they were usually subjected. Mr. Robertson is completing his fourth year in the department of chemistry and spent the past summer at the Mellon Institute, University of Pittsburg, employed in the inspection and research of refractories.

The Inspection of Ferrous Material.

Professor E. A. Allcut of the department of mechanical engineering of the University of Toronto at the regular meeting of November 16th, presented in an extremely lucid manner a short treatise on the inspection of ferrous materials. After comparing the relative severity of the test applied to materials used in ordinary engineering practice with those used in automobile and aeronautic manufacture Professor Allcut outlined the various tests applied to rolled sections, drawn tubes, forgings and castings. The speaker advised the holding of all materials in bond by the inspection department prior to its release when inspected to the various production departments. A system of identification marks, that would indicate the source of manufacture, the class of steel and the heat treatment to which it had been subjected was also carefully explained. Professor Allcut dwelt at some length with the injurious effects of overheating forgings and the detection of seams and piping in ingots. He favoured quenching in an oil bath rather than water when tempering these materials. The necessity of chemical and microscopic examination of castings as well as the importance of their proper design to facilitate the escape of gas and air during solidification was emphasized by Professor Allcut.

Considerable discussion took place chiefly in respect to the failure of castings. Among those taking part were — Professor C. R. Young, M.E.I.C., J. A. Freeland, A.M.E.I.C., A. U. Saunderson, A.M.E.I.C., G. W. Winkler, M.E.I.C., and Professor J. R. Cockburn, M.E.I.C.

The programme for the remainder of the fall session includes the following:

Nov. 30th — The Local Improvement Act, by R. C. Harris, commissioner of works, city of Toronto.

Dec. 7th — The Purification of Public Water Supplies, by M. J. Howard.

Dec. 14th — Discussion of the report of the committee of *The Institute* on Classification and Remuneration, lead by A. H. Harkness, A.M.E.I.C.

On January 11th the winter session will be opened by an informal dinner and entertainment to be held at the Engineers Club.

Peterborough Branch

R. C. Flitton, A.M.E.I.C., Secretary.

A meeting held on the evening of October 26th, in the assembly room of the Collegiate Institute was addressed by G. M. Middleton, E.E., Mem. A.I.E.E., of Toronto, who gave an interesting talk on "Vacuum Tubes for Radio Work". The speaker gave a very good explanation of the tubes in non-technical language and accompanied his address by demonstrations of radio apparatus, picking up, during the evening, part of a programme broadcasted from Pittsburg, Pa. He also showed how broadcasting was done, by actual demonstration. The functioning of radio apparatus was very well depicted by means of special moving picture films which Mr. Middleton provided. An invitation was extended to the general public to attend this meeting and there was a good attendance of interested listeners. The meeting was presided over by E. R. Shirley, M.E.I.C.

Annual Banquet

The third annual banquet and reunion of the Branch was held at the Empress hotel, on November 14th. The guests of honour included Brig.-Gen. C. H. Mitchell, C.B., C.M.G., D.S.O., B.A.SC., C.E., M.E.I.C., vice-president of *The Institute* and Dean of the Faculty of Applied Science of the University of Toronto, R.A. Ross, D.SC., E.E., M.E.I.C., past president of *The Institute* and prominent consulting engineer, Professor Peter Gillespie, B.A.SC., M.E.I.C., University of Toronto, past councillor of *The Institute*, Alex. J. Grant, M.E.I.C., chief engineer of the Welland canal, J. H. Hunter, M.E.I.C., representing Montreal Branch, Fraser S. Keith, M.E.I.C., general secretary of *The Institute*, as well as representatives of the ministerial, medical, dental, legal and teaching professions.

After due honour had been done to the toast to the King, the branch chairman, P. P. Westbye, M.E.I.C., who presided, welcomed the guests. In his speech Mr. Westbye said the Peterborough Branch felt highly honoured to have such a list of distinguished guests, for example; Brig.-Gen. C. H. Mitchell, whose record in the recent World War and whose reputation as an engineer were well known; R. A. Ross, who has been identified with so many important engineering projects, Professor Gillespie, the fruits of whose efforts in the sphere of science are so well known, and Alex. J. Grant who is in charge of that great Canadian engineering undertaking, the Welland ship canal. These men, he said, who appeared at a distance, by reason of their attainments to be quite above the rest of us, were at close range found to be very human after all — which was the surest evidence of their greatness.

Mr. Westbye spoke of the emblem of *The Institute*, the beaver, saying that these little animals attained their ends by *working together*, and were a good example to engineers in showing the necessity of being good neighbours and friends. He said that the members of the profession looked forward to these annual reunions as a potent means of engendering good feeling. These gatherings had the effect, he said, of stimulating and encouraging the members in their work for the advancement of the profession. At the conclusion of his address of welcome, Mr. Westbye called the roll of the guests, asking each to stand when his name was announced. At this stage of the programme a new engineering song was introduced by the Branch sextette who perform under the name of "The Lyre Birds" (*some spell it in this way*). This song was sung with great zest by all present — whether they could sing or not:—

(Tune: "**Sussex by the Sea**)

Oh we are the engineers — we are the E.I.C.
We work or jest with equal zest
And brothers all are we,
And when you see these letters, wherever you may be
You can tell them all that we stand or fall
For the good old E.I.C.
Then shout out loud for E.I.C.
Be stout and proud of E.I.C.
You can tell them all that we stand or fall
For the good old E.I.C.

The sextette rendered during the evening a number of original topical and community songs which added greatly to the amusement and enjoyment of those present. "The Lyre Birds" who at last year's banquet were known as a "Seven Man Sextette" have this year so adjusted their numbers as to be literally a "sextette". Their personnel is as follows:—W. M. Cruthers, A.M.E.I.C., A. L. Dickieson, A.M.E.I.C., A. B. Gates, A.M.E.I.C., P. Manning, A.M.E.I.C., H. Rose, S.E.I.C., W. E. Ross, Jr.E.I.C. W. H. Barry, who is an affiliate of the Branch, acted as pianist.

The toast to *The Institute* was proposed by the honourary chairman of the Branch, P. L. Alliston, M.E.I.C., who traced the growth of *The Institute* since its founding as the Canadian Society of Civil Engineers in 1887, when its membership was nineteen, to the present day with its membership totalling over five thousand, with twenty-three active Branches scattered across Canada from coast to coast. He said when we consider the influence *The Institute* has and will continue to have in the development of the Dominion we must feel proud and happy indeed to belong to its membership. With the establishment, he said, of the Lakehead Branch at Port Arthur in September, the twenty-third Branch was created. Our member of Council, Ross L. Dobbin, M.E.I.C., was the official representative of *The Institute* there, and in company with the general secretary, Fraser S. Keith, witnessed the birth of this new Branch. In this connection it is interesting to note that the Peterborough Branch which was founded only three years ago, was the thirteenth Branch so we may judge how rapidly *The Institute* is growing. Mr. Allison then spoke of the future of *The Institute*, saying that its growth would be made up in a large measure by the graduates of our colleges and technical schools. It was essential that these institutions should provide a liberal education such as would enable graduates to take their place on an equal footing with members of the other professions.

Brig.-Gen. C. H. Mitchell, M.E.I.C., in replying to this toast, spoke of the importance of Peterborough as one of the engineering centres of the Dominion. It had produced many of the men whose names were associated with some of Canada's greatest projects, from the late Sir Sanford Fleming down to men of our own day, such as Ross, Grant, Fairbairn and others. General Mitchell spoke of the progress that had been made in engineering, citing as an example, the contrast presented by the old G.T.R. locomotives with the giant "moguls" in use to-day. He said that railroad management envolved greater engineering problems than most people imagined, and went on to enumerate certain of these which though they appeared simple still remained unsolved. The solution of these problems was of vast economic importance, and he asked the question, "How is *The Engineering Institute of Canada* going to be a factor in solving these problems?"

General Mitchell here told a story of three stonemasons who were severally asked what they were doing. The first of them replied that he was cutting stone; the second said that he was working for wages; the third answered that he was helping to build a cathedral. General Mitchell said we as engineers should tackle our problems and do our work in the spirit of the stonemason who was "helping to build a cathedral". He said that if the engineers did not attack and solve the pressing problems of to-day that someone else would; business men, financiers and others. He cited a formidable list of problems which were demanding a solution at the present time:—

1. The solution of the economic organization and operation of our National Railways. This is our key problem and its correct solution will solve many more with ease.
2. The economic electrification of steam railways as distinct from the construction of new electric ones.
3. The economics of building new electric interurban and trunk railways alongside of or to feed existing steam roads.
4. Development of permanent highway systems, provincial and national.
5. Profitable long distance electric power transmission. It is now 250 miles, may it be 500 miles or 700 miles in this country?
6. Means of getting cheap electric power delivered to farming communities.
7. The operation of hydro-electric power plants in the very cold climate and frozen rivers of the far north from which with long transmission lines to centres of population we can distribute power to the vast west.
8. Recovery from our low grade ores and wastes from mines.
9. Electric smelting of our iron ores, especially in central Canada, by means of water power at very low costs.
10. Continued intensive exploration, reconnaissance, appraisal and research of our national resources. What more can we learn for instance about the possibilities of: — oil in the great northwest, copper and gold in the central north, diamonds in the clay of northern Ontario, and iron and gold in Labrador?
11. Construction and surfacing of our highways which will stand up under extreme traffic with our winter conditions.
12. The protection of concrete structures from attack by the alkali waters of the western provinces.
13. Development of cheaper motor traction for road, farm and industry.
14. Electric motor cars with light weight inexpensive storage batteries capable of operating over long distances.
15. The construction and operation of aeroplanes for very cold winter conditions.
16. The manufacture of motor fuels, as substitutes for gasoline from agricultural products, such as wood, corn and potatoes.
17. Wireless and radio development — at present only in its infancy.
18. The development of apparatus for using electricity for heating and heat processes in the manufactures (based on very cheap power).
19. Development of uses for our very large nickle resources, as an essentially Canadian metal.
20. The production of nitrogen and its compounds from the air by electric processes with water power, to make Canada independent, especially for refertilizing our western agricultural areas.

These are some of the things which we must set ourselves to solve, as a nation of energetic, alert people and it is clear that engineering plays a most important part and must take its active responsibility in their solution. It is our national duty at this time to look with cheerfulness on the future and to attack these problems with the best possible combination of our human and material resources.

R. A. Ross, M.E.I.C., also spoke responding to the toast to *The Institute*. His address opened in reminiscent vein and he recalled many humourous incidents of earlier days in Peterborough. He followed his prefatory remarks with some sound advice to engineers, saying that their fields of action should be extended beyond merely technical limits. He mentioned the name of Herbert Hoover as an instance of a man whose engineering ability had carried him into other important spheres of service. Mr. Ross intimated that such expansion of the field of the engineer was becoming imperative as a result of the large number of men graduating from the engineering faculties of our universities. If they had "to bludgeon their way into

these jobs" Mr. Ross believed that engineers should do so for the reason that they were especially qualified for them.

At the conclusion of Mr. Ross's speech "The Lyre Birds" again burst forth in song, contributing another original number:—

(Smiles)

Engineers who work on railroads,
Engineers who work on boats,
Engineers who never are seen working,
For whom some other guys are goats,
Engineers who have made a lot of money,
Engineers forever broke like me,
But all the best of them are members
And are proud of the E.I.C.

The toast to the Branches was proposed by Fraser S. Keith, M.E.I.C., who gave an interesting account of the progress being made by *The Institute's* branches which now number twenty-three, and the enthusiasm which they are evincing in *Institute* affairs from one side of the continent to the other. Mr. Keith emphasized the fact that the strength of *The Institute* lay in its Branches and their ever-increasing vitality was a good indication of the future greatness of *The Institute.*

J. H. Hunter, M.E.I.C., rose in response to this toast and conveyed the good wishes of the Montreal Branch. He spoke of the growth of that Branch, and showed how, by concerted efforts on the part of its officers in increasing its membership, its development had been phenomenal. The meetings, he said, were always well attended and it would not be long before it would be necessary to call them more frequently.

Professor Peter Gillespie, M.E.I.C., responded also to this toast, conveyed the felicitations of the Toronto Branch, and, as usual, found the Peterborough Branch a highly appreciative audience for his excellent address.

The chairman called upon Alex. J. Grant, M.E.I.C., of St. Catharines, who spoke of the Welland ship canal. E. L. Miles, M.E.I.C., of Lindsay, Ont., who is county engineer for Victoria county, also spoke.

The toast to the Sister Professions was proposed by A. L. Killaly, M.E.I.C., who said how much the Peterborough Branch appreciated having representatives of the ministerial, medical, dental, legal and teaching professions with them on this occasion.

The Rev. Robert Pogue replied for the Ministerial Association, Dr. Edward Wood for the Medical Association, Dr. J. J. Craig for the Dental Association, Mr Strickland for the Law Society, and R. F. Downey for the Teachers' Institute. Mr. Downey made a very brilliant speech, the theme of which was that whatever might be the heights of fame to which engineers might rise, they owed their beginnings to the "little red school house".

There was now presented what was announced as a "Scientific Demonstration" with H. Rose as "chief demonstrator". The apparatus used in this demonstration consisted of a unique and quite original radio set, the product of the fertile brains of some of the engineers of the Canadian General Electric Company. Some of the news "picked up" during the demonstration was specially interesting to members of the Branch.

The singing of "God Save The King" concluded one of the most successful gatherings of the engineers of the Peterborough Branch.

REGISTRATION

C. H. Mitchell	R. A. Ross	R. B. Rogers
Peter Gillespie	Fraser S. Keith	Fred. Newell
R. F. Downey	E L. Miles	W. E. Reesor
G. Coutts	C. N. Geale	D. L. McLaren
Geo. C. Carruthers	W. G. Cornell	H. A. Fife
Thos. A. Lang	P. Alexander	R. S. Cotton
F. M. Somerville	Wm. Sangster	J. A. G. Goulet
V. S. Foster	D. W. Roseburgh	H. M. Armstrong
H. R. Sills	A. E. Caddy	H. E. Nancarrow
J. H. Johnson	Alvin L. Malcolm	A. J. Wood
F. D. Gifford	W. G. Perks	A. D. Allen
N. D. Seaton	John Barnes	P. Manning
W. M. Cruthers	W. E. Ross	A. B. Gates
H. A. Cranfield	W. H. Barry	Hugh E. Rose
A. L. Dickieson	A. H. Munro	R. H. Parsons
Geo. G. Gladman	F. H. Dobbin	B. Ottwell
F. Bowness	R. E. Hinton	P. H. Smedmor
G. B. Smith	James Mackintosh	John Crane
H. O. Fisk	W. G. Henderson	Edw. Wood
(Rev.) Robt. Pogue	J. J. Craig	A. L. Killaly
Alex. J. Grant	P. L. Allison	J. H. Hunter
B. L. Barns	R. C. Flitton	J. W. Stevenson
V. J. McElderry	J. F. Strickland	R. L. Dobbin
Peter P. Westbye	L. Potvin	J. J. Dorris.

OTHER SOCIETIES NEWS

Canadian Engineering Standards Association

The semi-annual meeting of the Main Committee of this association was held November 13th, in Ottawa, at the offices of the association, H. H. Vaughan, M.E.I.C., in the chair. After the transaction of formal business, the secretary reported that the membership of the association as of October 1st was 285, all members taking part in the work of various active committees of the association.

Progress reports of the various working committees were presented, and it was announced that the specifications for steel highway bridges; incandescent lamps; watthour meters; wood poles for transmission lines; flexible wire rope and strand for aircraft; and commercial bar steel are well advanced or are ready for publication, that for steel highway bridges being in the press. The specification for flexible wire rope and strand for aircraft was approved for publication. In conformity with a request from the Secretary of State's Department, a formal resolution was passed changing the location of the head office of the association from Montreal to Ottawa. The secretary's report on the activities of the association during the past six months was received and approved.

The personnel of a Sectional Committee on Road Materials and Construction under the chairmanship of A. W. Campbell, M.E.I.C., Dominion Commissioner of Highways, was approved, this committee including representatives of all the provincial highway authorities and having as its principal object the obtaining of

Dominion-wide agreement on nomenclature, definitions and tests for road materials; and co-operating with the Committee on Road Construction recently appointed by *The Engineering Institute of Canada.*

A request having been received from the American Engineering Standards Committee for co-operation in unifying divergent local requirements for traffic signals on highways, it was decided to request the highway departments of the nine provincial governments, the Board of Railway Commissioners, the Canadian Automobile Association and other bodies interested in automobile work, the larger cities of the Dominion, *The Engineering Institute of Canada*, and the railway authorities to nominate members on this committee. The functions of this committee will be to make a survey of present conditions in Canada, prepare recommendations accordingly, and consider these in connection with the draft suggestions to be prepared in the United States and forwarded by the American Engineering Standards Committee. It was decided to take similar action in connection with a request for the association's co-operation in connection with specifications for electric overhead crossings, the organizations interested in this case being the Board of Railway Commissioners, the steam and electric railway authorities, the power companies, and various power commissions, the provincial governments, and the various telegraph and telephone companies.

A suggestion from the Sub-Committee on Concrete and Reinforced Concrete that action should be taken looking to the preparation of specifications for reinforced concrete poles was approved.

The secretary reported that a number of favourable and some unfavourable replies had been received to the invitation sent out by the Honourable Mr. Robb, Minister of Trade and Commerce, for an interprovincial conference to be held under the auspices of the association regarding the possibility of obtaining Dominion-wide agreement as to requirements for the design, inspection and installation of electric fittings, appliances and equipment, and it was hoped that the conference in question would shortly be held. It was announced that the grant to the association from the Dominion Government has been continued for the fiscal year 1922-23, and other contributions to the funds of the association were reported. The auditor's statement and balance sheet as of October 1st, was received and approved.

British Engineering Standards Association

The British Engineering Standards Association has issued the following British Standard Specifications within the past few months.

B.S.S. No. 7-1919; a revision of the July 1919 edition, of specification for Dimensions of Insulated Annealed Copper Conductors for Electric Power and Light including Pressure Tests.

B.S.S., No. 137-1922; for Porcelain Insulators for Overhead Power Lines (3,000-150,000 volts).

B.S.S., No. 138-1922; for Materials and constructional strength of Chemical Fire Extinguishers.

B.S.S., No. 143-1922; for Long Sweep Type Malleable Iron Pipe Fittings for Steam, Water and Gas.

B.S.S., No. 152-1922; for Dimensions in Metric Measure of Insulated Annealed Copper Conductors for Electric Power and Light, including Pressure Tests.

B.S.S., No. 153-192; for Girder Bridges. Part 1, Materials; part 2, Workmanship.

B.S.S., No. 154-1922; for Malleable and Soft Cast Iron Pipe Fittings for Steam, Water and Gas.

Society of Chemical Industry

Domestic fuel problems were discussed at the first meeting of the season of the Ottawa section of the Society of Chemical Industry held in the Daffodil Tea Rooms on November 9th. It was brought out that much of the difficulty experienced in burning peat in hot water furnaces was due to the fact that too much fuel was thrown, thereby checking the long flames which emit the heat. F. B. Hambly was chairman and invited a discussion on the papers. A. E. MacRae, A.M.E.I.C., was secretary.

Mr. Hambly showed that to burn one pound of coal required 10 pounds, or 120 cubic feet of air, thus an average furnace theoretically uses 12,000, cubic feet of air daily and on the regulation of the air supply depends the success of the furnace operation. Too much air carries much heat up the chimney. The topic of the evening was "Characteristics of Different Types of Fuel and Furnaces". The first part of the programme was handled by Messrs. R. E. Gilmore, J. H. H. Nicolls and H. Kohl, superintendent and engineering chemists respectively of the Government Fuel Testing Laboratory, and the second part by E. S. Malloch, A.M.E.I.C., engineer of Fuels and Fuel Testing Division of the Department of Mines.

The subject of household fuels was divided into three parts, viz., (a) the relative value of chemical and physical analysis of coal and other fuels, (b) the classification of the higher types of fuels, and (c) the ignition temperature of different fuels.

National Exposition of Power and Mechanical Engineering

The National Exposition of Power and Mechanical Engineering will open at 1.00 p.m. on Thursday, December 7th, 1922, at the Grand Central Palace. It will immediately follow the Annual Meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers and will remain open until December 13th, except on the intervening Sunday.

This Exposition will be the first large scale attempt to display mechanical and power plant apparatus so that the present extraordinary state of development will be apparent not only to the highly trained technical man but to the layman with little knowledge of the severe problems involved in the engineering design and operation of combustion apparatus and power-generating machinery.

The development of the power station itself will be illustrated by the exhibition of a series of models of the important central stations in New York City. The original station erected by Thomas Edison in Pearl Street will appear beside the more modern Waterside Stations and the recent Hell Gate Station. The representation of this latter station is a faithfull reproduction built to a scale of one-quarter of an inch to the foot. In addition to the public central stations mentioned above it is planned to show a model of one of the well known large industrial power plants. To further enhance the educational and informative value of the exposition each of the exhibitors will demonstrate the fundamentals

underlying the operation of their apparatus by simulating actual operating conditions as nearly as possible in their exhibits. If practical apparatus will be shown in motion, otherwise complete diagrams will be displayed.

The Engineering Division of the National Research Council

The Division of Engineering of the National Research Council of the United States has just issued a booklet giving much information about its organization, work and personnel. The National Research Council is a co-operative organization of American societies and scientific men concerned with the physical, mathematical and biological sciences, and the applications to human welfare through the agricultural, engineering and medical arts. Approximately eighty societies are included. Among the Council's members are also business men interested in the industries. The main offices of the National Research Council are at 1701 Massachusetts Avenue, Washington, D.C., pending the completion of its permanent building near the Lincoln Memorial. The Division of Engineering has offices in Engineering Societies Building, 29 West 39th Street, New York, in order to facilitate co-operation with the engineering societies and Engineering Foundation.

Copies of the pamphlet and other information will gladly be sent upon request, addressed to Alfred D. Flinn, Chairman, or William Spraragen, Secretary, 29 West 39th Street, New York.

Publications

Machinists' and Draftsmen's Handbook by Peder Hobben. The third edition of this reference book has just been published by D. Van Nostrand Company, New York, and in addition to the large amount of conveniently arranged data, given in the previous editions, it embodies revisions in the steam and electrical sections to conform with the most recent practices. The book is designed as a ready practical reference book for those interested in mechanical work, and contains tables, rules, and formulas, with just sufficient explanation and examples to give an understanding of the principles applied. The first part is devoted to mathematics, with sections on arithmetic, algebra, logarithms, weights and measures, geometry and mensuration. This is followed by sections of strength of materials, mechanics, belts, rope transmission, pulleys, fly-wheels, shafting, bearings, gear teeth, screws and pipes, while six short sections at the end contain notes on hydraulics, steam, copper wire, electrical terms and blue printing, with a short general section on shop notes.

Mechanical Laboratory Methods. — A reference book for the testing of instruments and machines in the mechanical engineering laboratory and in practice, by Julian C. Smallwood, M.E., has been recently published by D. Van Nostrand Company, New York. This book is divided into three sections, the first dealing with the testing of instruments, such as weight and forces, pressure, angular velocity, etc.; the second deals with the analysis of combustion as constituents of fuels, heat value of fuels and products of combustion; the third section touches on the various items of a power plant. It also includes tables of logarithms, densities of water, steam-vapour tension tables, properties of steam, Mollier diagram, properties of ammonia, hygrometry, total heat of air steam mixtures, and the American Society of Mechanical Engineers code on definitions and values.

Canadian Highways and Roads. — The Highways Branch of the Department of Railways and Canals, of which A. W. Campbell, M.E.I.C., is chief commissioner, has just issued a most interesting pamphlet giving general information regarding highways, which is entitled, "Bulletin no. 1, Canadian Highway and Roads" and may be secured on application to the department.

CORRESPONDENCE

Concrete Proportioning Theories Discussed

November 8th, 1922.
8 Strachan Avenue,
Toronto.

Editor, *Journal*:—

Dear Sir:—

I cannot let pass without comment, Prof. G. M. Williams', A.M.E.I.C., paper, "Some Fallacies in Concrete Proportioning Theories", which appeared in your issue of September. The assertions he makes there are not new but because of the dogmatic way in which his statements are presented, they would lead one to believe that the claims he has made are established facts. This is far from being the case.

In June 1918, Mr. L. N. Edwards, then with the City of Toronto, presented his method of Proportioning the Materials of Mortars and Concretes by Surface Area of Aggregates. In December of the same year, Prof. Duff A. Abrams M.E.I.C. of the Lewis Institute, Chicago, brought out another method of proportioning concretes based on fineness modulus and on what is now known as the water-cement ratio theory. In July 1919, Prof. Williams and Mr. Watson Davis, both of whom were then connected with the Bureau of Standards, Washington, D.C., published an article in which they criticized strongly both the conclusions and test data of these two methods. Supporting their claims were the results of tests made by themselves. These criticisms were answered by Messrs. Edwards and Abrams and commented upon by others. Since then other papers on the subject of these theories have been published but without much new information on the subject appearing.

I will not attempt to review the details of this controversy or to express any opinions on its merits, but I will call attention to the fact that Prof. Williams is the only critic to come forward and condemn in their every feature both methods of proportioning, to express doubt as to the authenticity of the data on which they are based and to claim that sound principles of testing were violated in obtaining this data and that the frequent references by Prof. Williams to published articles as supporting his opinions are without exception to articles written by himself and the tests referred to are tests made by him and his associates.

The criticisms which have been made by Prof. Williams have been answered by both Mr. Edwards and Prof. Abrams and their replies are fully as convincing to the average reader as are the former's arguments and criticisms. With the exception of the fact that neither Mr. Edwards nor Prof. Abrams used the flow table in their early tests, the methods pursued by them are those recognized to-day amongst testing engineers as "sound in principle", while consideration of their writings does not lead one to the conclusion that they were not fully conversant with and had a proper appreciation of the fundamentals of testing.

The Hydro-Electric Power Commission of Ontario with which the writer is connected has been successfully using methods of proportioning based in part on the theories of both Messrs. Abrams and Edwards. Consequently we have become involved occasionally in the controversy which has resulted from Prof. Williams' attacks upon them. Replying to one of these directed at an article describing the successful application of the methods used by the Commission, Engineering News-Record, March 17th, 1921, the writer said in part: "We hold no brief for either the surface area or water-cement theories. There are data which cannot be explained by either and which are apparently in direct contradiction thereto but there are also data which support them and which cannot be ignored. We have never claimed them as general in their application but, used as we have used them, they form valuable tools by which proportions can be more accurately set than by any scheme of equal simplicity yet developed. We fully expect them to be superseded at some future time when our knowledge of concrete has broadened but until such time arrives and a better tool is found, they should not be utterly condemned."

We have not altered our views since that time although we have had the theories in question under examination in the laboratory and have used them in proportioning some 400,000 cubic yards of concrete on the Queenston-Chippewa development.

The writer's experience with the flow table has not led him to the conclusion that it has "fully demonstrated its ability to accurately measure the consistency of concretes varying widely in cement content and aggregate gradations". The apparatus has been used for about two years in the laboratories of the Hydro-Electric Power Commission of Ontario and the experience there has been that while it is an improvement over other tests for consistency which has been tried, it still leaves much to be desired. It has many of the faults of the slump test but to a less degree and the range of mixes and gradations over which it can be used is greater. It is hardly right to say that it has been standardized as work with this purpose in view is, we understand, now in progress in the Bureau of Standards, where the flow table was first developed.

R. B. YOUNG, A.M.E.I.C.,
Assistant Laboratory Engineer,
Hydro-Electric Power Commission of Ontario.

Specifications for Belgium Railway Contracts

Consulat de Belgique
Montreal, November 22nd, 1922.

Editor, *Journal:*—

Dear Sir,

I beg to inform you that the Department of Railways, Marine, Posts and Telegraphs from Belgium has sent to this Consular office the specification books concerning the supplying, in 1923, of railway ties and special squared timbers of various dimensions, in oak and beech, for switchers, turnouts, etc.

These publications can be consulted in this Consular office and will probably be interesting to Canadian merchants desiring to send in tenders.

I would be very much obliged to you to attract their attention on the foregoing. Thanking you in anticipation, I beg to remain, gentlemen,

Yours very truly,
JOHN VAN RICKSTAL,
Consul.

Trade Publications

The Taylor Stoker is the name of a very handsomely prepared booklet, published by the American Engineering Company of Philadelphia, Pa., and distributed locally through the Taylor Stoker Company, Limited, of Toronto and Montreal. This publication contains a large number of illustrations of plants in which the Taylor Stoker is installed, together with a brief description in each case of the type of equipment used.

B. F. Sturtevant Company, Hyde Park, Boston, Mass., have recently distributed their catalogue No. 295, describing and illustrating Sturtevant Air Washers. In it are included details of performances and dimensions, and a number of tables of relative humidity, grains of moisture per cubic foot, dew point temperatures, weight of saturated air per cubic foot for dry and wet bulb temperatures of the sling psychrometer. Copies of this catalogue may be secured upon request.

Current Meters for use in River Gauging. A Committee on Gauging Rivers and Tidal Currents has been appointed by the Department of Scientific and Industrial Research to collect information relating to methods and appliances used in investigations bearing upon measurements of river, tidal and other currents and to the testing and standardization of such apparatus, and to test appliances that appear to be suitable for use in the study of the water power resources of this country. Under the direction of this Committee a report has been prepared which summarizes the information available as to the conditions affecting the design and use of current meters, and gives a description of the types now in use. The report is accompanied by a brief bibliography of the literature of current meters.

Mechanical Devices for Loading and Unloading Motor Vehicles to reduce Terminal Delays. A small illustrated pamphlet by W. D. Williamson, has been published by the authority of the Institution of Automobile Engineers, Westminster, S.W., and contains descriptions of devices of various designs for the mechanical handling of the loads of motor vehicles. The subject is treated under two principal headings: loading devices and unloading devices; the former type being described under three subheading: interchangeable bodies, mechanical devices at the loading station, and mechanical devices on the vehicle itself. Special reference is made to the handling of liquids, a system for municipal work, and filling coal at a large colliery. while some interesting data relative to the running cost of a 4-ton lorry is also given. All equipment referred to in the pamphlet is illustrated either by drawings or actual photographs.

Ingersoll-Rand Products. — The most recent catalogue of the products of the Canadian Ingersoll-Rand Company has recently been published and is prepared in a very convenient loose-leaf style with appropriate cover in order that the data contained therein may be kept up to date. This volume together with bulletins numbers K-701 and K-702 and number 3045-C which have also recently been published, are available to the members of the Institute on request.

Preliminary Notice

of Applications for Admission and for Transfer

20 November, 1922

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in December, 1922.

FRASER S. KEITH, Secretary.

*The professional requirements are as follows:—

Every candidate for election as MEMBER must be at least thirty years of age, and must have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in some school of engineering recognized by the Council. The term of twelve years may, at the discretion of the Council, be reduced to ten years in the case of a candidate who has graduated in an engineering course In every case the candidate must have had responsible charge of work for at least five years, and this not merely as a skilled workman, but as an engineer qualified to design and direct engineering works.

Every candidate for election as an ASSOCIATE MEMBER must be at least twenty-five years of age, and must have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineers' office, or a term of instruction in some school of engineering recognized by the Council. In every case the candidate must have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years

Every candidate who is not a graduate of some school of engineering recognized by the Council, shall be required to pass an examination before a Board of Examiners appointed by the Council, on the theory and practice of engineering, and especially in one of the following branches at his option, Railway, Municipal, Hydraulic, Mechanical, Mining or Electrical Engineering.

This examination may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five years or more years.

Every candidate for election as JUNIOR shall be at least twenty-one years of age, and must have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the Council, if the candidate is a graduate of some school of engineering recognized by the Council. He shall not remain in the class of Junior after he has attained the age of thirty-three years

Every candidate who is not a graduate of some school of engineering recognized by the Council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects, Geography, History (that of Canada in particular), Arithmetic, Geometry, Euclid (Books I.-IV. and VI) Trigonometry, Algebra up to and including quadratic equations

Every candidate for election as ASSOCIATE shall be one who by his pursuits scientific acquirements ,or practical experience is qualified to co-operate with engineers in the advancement of professional knowledge

> The fact that candidates give the names of certain members as references does not necessarily mean that their applications are endorsed by such members

FOR ADMISSION

[illegible] WILLIAM, of Bank Str. Chambers, Ottawa. Born [illegible], England, Dec. 25th, 1871. Educ., Miners Inst., [illegible] apprt'ce., mech., engr'g., [illegible] yrs. gen'l engr'g. Walker Bros., Ltd., [illegible] the shop [illegible] Builders Manu [illegible] Canada Foundry, since 1913, distr. sales engr., Canadian Crocker Wheeler Co., Ltd., St. Catharines, Ont.

References: [illegible], C. P. Edwards, [illegible]

BALDWIN—ALLAN LUNDY, of Brockville, Ont. Born at Quebec, P.Q., Feb. 17th, 188[illegible] Educ., I.C.S.; 1907-09, chainman and rodman, Canadian Nor. Railroad, 1910-11, pile and concrete inspectr., and 1911-12, instr'man., C. N. Rly.; 1913, res. engr., Can. Nor. Railroad; 1914 (June-Nov.), inspectr., Dept. of Public Highways; 1914-16, res. engr., Toronto Hamilton Highway Commn.; 1917 (Jan.-Aug.), locating and purchasing of right of way for Calabogie Light and Power Company's Transmission line; 1917 (Sept.-Dec.), res. engr., Dept. of Public Highways;Jan./18-Mar. 19, Lieut., Can. Engrs.; 1919 (April-June), instr'man, Toronto York Radial; June 1919 to date, res. engr., Dept. of Public Highways, Brockville, Ont.

References: W. A. McLean, G. Hogarth, C. Johnston, A. A. Smith, R. C. Muir, H. T. Routley and G. H. Bryson.

CARPENTER—GORDON VICTOR, of 1093 Bordeaux Str., Montreal, Que Born at Montreal South, Nov. 25th, 1900; Educ., Grad. Comm. and Tech. High School '17; 1917 (May-Oct.), dftsman., Can. Rubber Co. 1918 (Mar.-Dec.), dftsman., Canada Cement Co.; 1919 (Jan.-Mar.), dftsman, Northern Electric Co.; 1919 to date, mech. dftsman., J. M. Robertson, Consulting Engineer, Montreal, Que.

References: J. M. Robertson, H. W. Fairlie, G. S. Davis, J. Baxter, A. R. Henry.

CONKEY—CHARLES ROLLAND, of Fort William, Ont. Born at Minneapolis, Minn., Oct. 5th, 1887; Educ., Engr. of Mines, Univ. of Minn., '10; mining engr., Great Northern Location survey, Tower Minn.; district engr., Oliver Mining Co., Ercleth, Minn.; 1916-19, ch. dftsman., 1919-22, ch. engr., designing grain elevators, warehouses, etc.,in full chg. design'g., estimating and executive work, Tegler Construction Company; to date, ch. engr., Fyles Constrn. Co., Ltd., Fort William, Ont., Minneapolis, Minn.

References: G. R. Duncan, F. Y. Harcourt, H. S. Hancock, G. Blanchard, G. H. Burbidge.

DINGLE—JAMES CHRISTIAN, of 182 Furby Str., Winnipeg, Man. Born at New York, N.Y., Jan. 29th, 1899. Educ., B.S., C.E., Univ. of Manitoba, '21. 1919 (May-Oct.), in chg. of actual road work being done under the Good Roads Act of Manitoba in the Munic. of St. Andrews under G. Pierson; 1920 (May-Oct.) levelling party locating and construct'g. branch lines for C. P. R., under C. E. Flint; engr. for Macaw and MacDonald, contractors, Kenora, Ont.;1921(May-Dec.), asst. engr., drainage dept., on level party for the Drainage Commn. of Manitoba, D. L. McLean, engineer; 1922 (Feb.-Sept.), asst. engr., Good Roads Dept., Man.; at present engr. for contractors taking rock out of the channel leading to the Backus-Brooks power house, Kenora, Ont.

References: J. N. Finlayson, E. P. Fetherstonhaugh, D. L. McLean, W. H. Hunt, J. C. D. Taylor, J. W. Dorsey, C. E. Flint.

FINLAYSON—ERNEST HERBERT, of 171 Cameron Str., Ottawa, Ont. Born at Toronto, Ont., Mar. 28th, 1887. Educ., B.Sc., (Forestry) Univ. of Toronto, '12; 1910 (5 mos.), asst. chief, forestry survey, Rocky Mtns., and 1911 (5 mos.), chief, forest survey party, Rocky Mtns., Dom. Forestry Branch; 1912-14, inspectr. of fire ranging, Forestry Branch, and Fire Inspctr., Board of Rly. Commnrs., having chg. of Forest Protection organization on Dominion Lands of Manitoba, Sask., and Alberta; 1914-20, (first five months) asst. distr. inspectr. of Forest Reserves, Alberta distr., Dom. Forestry Branch, afterwards distr. inspectr., in full chg. of Forestry Branch operations in Alberta, work involved administration of eight forest reserves and through large fire ranging districts; 1920 to date, forest protection specialist, third office, Forest Branch, Dept. of the Interior, Ottawa, Ont.

References: J. B. Challies, C. P. Edwards, K. M. Cameron, O. S. Finnie, D. R. Cameron.

GARLAND—JAMES H., of 466 Guy Str., Apart. 26, Montreal, Que. Born at Providence, R.I., U.S.A., Nov. 20th, 1871 Educ., Preparatory School, Phila, Pa; 1887-91, served appr'teeship., Henry Wisston Sons, and worked there until 1898; 1902, erecting engr., on outside work in Port Rico, Cuba, Mexico, Canada and parts of the U.S.A., erecting sugar machinery and hydraulic turbines; 1902-20, installn. hydraulic turbines for Shawinigan Water and Power Co., Shawinigan Falls, Que., installn hydraulic turbines and aux. equipment at Cedars for M.L.H. and P. Co., and installn of hydraulic turbines as follows:—for Appalachian Power Co., Virginia, Va., Niagara Falls Power Co., Niagara Falls, U.S.A., and Noniga-Gto for Gto. Power Co., Mexico; 1914-19, chg. all mech. equip'mt. for Canadian Electro Products Co., on the manufacture of Aceton during the War for the British Munition Board also United States Aero Board; 1920 to date, gen. supt., Dominion Engineering Works, Ltd., in chg. of manufacture of hydraulic turbines and paper making machinery.

References: J. C. Smith, G. H. Duggan, K. B. Thornton, R. M. Wilsn, G. E. Bell W. A. B. Hicks, C. W. Larner, H. P. Rust.

HALIBURTON—WILLIAM MORDAUNT, of 153 Strathearn Ave., Montreal West, P.Q. Born at Woodstock, N.B., Feby. 9th, 1887. Educ., Electricity, Pratt Inst. of Tech., Brooklyn, '08, and Sci., King's Coll., Windsor, N.S., 1904-06; 1909-11 head of shop laboratories, Western Elec. Co., Chicago; 1911-19, head of laboratories Northern Elec. Co., Montreal; 1919-22, power apparatus and appliance engr'g., Northern Elec. Co., to date, design and mfg. elec'l. apparatus, including telephone head set for radio reception, power relays, high tension equipment etc., Haliburton & White Limited, Montreal, Que.

References: G. P. Cole, P. Ackerman, G. E. Templeman, H. W. Fairlie, J. H. Morley

HOBSON—NORMAN C., of Sandwich, Ont. Born at Woodstock, Ont., Dec. 19th, 1897, Educ., grad., Detroit Tech. Coll., appl. sci. and maths., and American Corr. School in mech. engr'g.; two years, plant engr., engr'g. dept., Canadian Salt Co. to date, departmental supt., chemical branch, Canadian Salt Co., Sandwich, Ont.

References: H. Thorne, A. J. Riddell, L. Tillson, E. J. McIntyre, C. R. McColl.

IVEY—CHARLES H., of London, Ont. Born at London, Ont., June 26th, 1889. Educ., B.Sc., (E.E.) McGill Univ., '11; chain boy on survey gang and around Nor. Elec. Co.; 1912 to date, works engr. and chemist, Empire Brass Manufacturing Co., Ltd., London, Ont.

References: H. L. Trotter, E. V. Buchanan, I. Leonard, W. J. Forbes-Mitchell, H. B. R. Craig.

McLEISH—JOHN, of Ottawa, Ont. Born at Toronto, Ont., Nov. 1st, 1874. Educ., B.A., Univ. of Toronto, '96. 1897-1907, asst., Mines Section Geological Survey; 1920-21, acting director, Mines Branch; 1921 to date, director, Mines Branch, Dept. of Mines, Ottawa.

References: L. H. Cole, B. F. C. Haanel, R. L. Peek, O. S. Finnie, W. H. Boyd, J. White.

MULLIN—JAMES WALTER, of Glace Bay, N.S. Born at St.Eugene, Ont., Nov 9th, 1889. Educ., B.Sc., (E.E.) McGill Univ., '14, 1914, student course, going through various factory depts. and on installn., Northern Elec. Co.; 1915, asst. receiving engr., Louisburg Marconi Station : 1916-18, as follows, with Marconi Transatlantic Station, 1916, shift engr., 1917, asst. engr. in chg., 1918, cert. engr. in chg.; 1919-22, engr. in chg., Marconi Transmitting and Receiving Stn., Glace Bay and Louisburg; at present engr., in chg. 6 kw. ship stn., and new stn., for intercity work now being erected.

References: K. H. Marsh, C. M. O'Dell, K. G. Cameron, S. C. Mifflen, D. Morrison.

PALMER—JOHN, of Montreal, Que. Born at London, England, June 20th, 1881; Educ., B.Sc., (Eng.), London University, '09; 1898-01, articled pupil, Johnson & Phillips, elect'l. contrs., London, England; 1898-01, dftsman., (steam engines), Vauxhall Iron Works, London; 1902-05, seagoing engr., Allan line, Lamport & Holt Line; 1905-10, ch. engr., City of Southampton, England; 1910-12, dftsman. (switchgear), Canadian Westinghouse Co.; 1912-13, erecting, Canadian Westinghouse Co.; 1913-20 (excepting war service), distr. engr., Canadian Westinghouse Co., Calgary; 1916-19, Lieut. 102nd Inf. Battn. O.M.F. of C.; 1920 to date, district engr., Canadian Westinghouse Co., Montreal, Que.

References: C. J. Desbaillets, H. Holgate, J. S. H. Wurtele, H. U. Hart, H. B. Dwight, C. F. Medbury, J. H. Trimingham, W. F. McLaren.

SINCLAIR—JOS. HORACE, of 838 King Str., London, Ont. Born at Smiths Falls, Ont., Dec. 10th, 1883. Educ., Tech. School, Toronto, 1903-05, and I.C.S. course, (elec. and mech. engr'g.), 1906-07; 1905, erect'g. engr., John Inglis Co., and Polson Iron Works, Toronto; 1906, erect'g. engr., Copper Cliff for Nordberg Mfg. Co., Milwaukee, Wis.; 1911-20, sales and genr'l. engr'g. work with Gormans Limited, Edmonton and Calgary, Alta.; 1916, engr. in chg. of install'g. gold dredging plant on Sask. River above Edmonton, for Saskatchewan Gold Co.; at present, sales mgr., London Concrete Machinery Co., Ltd., London, Ont.

References: G. W. Craig, E. V. Buchanan, H. A. Brazier, H. S. Phillips. J. S. Tempest, C. Chambers.

STEPHEN—JOHN, of 26 Ellsworth Ave., Toronto, Ont. Born at Toronto, Feb. 25th, 1887. 1904-08, machine-shop, shipyard, mould loft and dft'ing. office, Canadian Shipbuilding Co., formerly of Toronto; 1908-10, ship dftsman., with A. Angstrom, consltg. naval arch't. and marine engr., Toronto and Montreal; 1910-15, structr'l. steel dftsman., checker and designer, Toronto Structural Steel Co.; 1915 (Feb.-Nov.), dftsman. and 1917-18, leading dftsman., on steel ship constrn., Polson Iron Works, Ltd., Toronto; 1915-16, ch. dftsman., Davie Shipbuilding and Repair Co., Lauzon, Levis, P.Q.; 1918, (Jan.-June), Chief Hull Dftsman, Canadian Allis Chalmers, Ltd., Toronto: 1918-19, ch. dftsman., Polson Iron Works, Ltd., Toronto, Ont.; 1919-20, ch. dftsman., Dominion Shipbuilding Co., Toronto; 1920 to date as follows: 1920-21, structr'l. designer, 1921-22, asst. ch. dftsman. in chg. structr'l. group, Feb. 1922 to date, asst. to struct'l. engr., with the Hydro-Electric Power Commn. of Ontario, Toronto, Ont.

References: J. Hyslop, J. McNiven, J. W. Smith, N. L. Crosby, H. V. Armstrong, E. T. J. Brandon.

SUTHERLAND—MITCHELL SCOBIE, of Cochrane, Ont. Born at Ardrossan, Scotland, Jan. 9th, 1885. Educ., Fairfield High School, Liverpool, England; 1904-07, chainman, rodman, C. P. R.; 1907-08, timekeeper and cost clerk, D. G. Loomis & Sons; 1910-11, rodman and 1911-12, instr'man., Algoma Central Rly.; 1912 (May-Oct.), instr'man., Can. Nor. Ontario Rly; 1912-14, res. engr., C. N. Ont. Rly; 1914(May-Dec.), asst engr., Toronto Eastern Rly.; 1915-19, overseas; 1919-21, vocational officer, Dept. Soldiers Civil Re-establishment, Stratford, Ont.; 1921 (Oct.-Dec.), leveller, Nipissing Central Rly.; 1921 (Dec.-Feb.)-1922, leveller, Temiskaming & Nor. Ont. Rly.; 1922 to date, res. engr., Temiskaming & Nor. Ont. Rly., James Bay Extension.

REFERENCES—S. B. Clement, A. J. Gayfer, R. Fleming, J. E. Letson. A. L. McDougall.

THOMPSON—HAROLD MORFIN, of 152 Belmont Ave., Hamilton, Ont. Born at Ordsall, England, Dec. 4th, 1892; Educ., certificates—2nd class M.C.U.E.I., in Heat Engines, '11. 2nd class British Board of Education in Machine Constrn. and Drawing, '10, and diploma for Industrial Management Efficiency, LaSalle Extension University, Chicago, '22; 1907-13, indentured mech. engr's. appr'tce., Marshall Sons & Co., Ltd., Gainsborough, England (shops 5½ yrs. and drawing office 6 mos.), junr. dftsman. until Aug. 1914, enlisted in R.F.C.; 1915-18, overseas, as Sergt. Mech., no. 3 squadron, R.F.C., and R.A.F.; 1919, demobilized Honorary 2nd Lieut., after serving 4 mos. in chg. drawing office, no. 5(E) A.R.D.,R.A.F.;1919-20, asst. chdftsman.,design mill engines, surface and jet condensors and steam power plant layout, supervisn. special constrn. in shops; emigrated Aug. 1920; Sept. 1920 to date, mech. engr. and design'g. dftsman., chg. design, supervisn. and constrn., also Asst. to East Side Supt., Sawyer Massey Company, Limited, Hamilton, Ont.

References: R. Hobson, E. H. Darling, W. F. McLaren, F. W. Paulin, R. F. Ogilvy.

VERNER—EDWIN ERNEST GEORGE HAMILTON, of Port Coquitlam, B.C. Born at Castlederg, Ireland, Jany. 27th, 1886. Educ., public and pvte. schools, and special course in maths., under tutor 1899-1901 incl.; 1902 and '03, pupil appr'tce., W. Rigby & Co., engrs. and contrs., London; 1904, junr. asst. engr., Cape to Cairo Rly.; 1906, topogr., Can. Nor. Rly. Co.; 1907, instr'man., Temiskaming and Nor. Ont. Rly. Co.; 1908 and '09, in chg. field surveys for Col. T. H. Tracy, consltg. engr., Vancouver, B.C.; 1910 and '11, supt. of surveys, Western Canada Power Co., Vancouver; 1912, supt. of constrn., district of Coquitlam; 1913, municipal engr., dist. of Coquitlam; 1914-16, city engr., Port Coquitlam; 1917 and part 1918, municipal engr., district of Langley, B.C.; 1918-20, asst. distr. engr., 1921, acting distr. engr., and from May 1922 to date, distr. engr., Dept. of Public Works, Province of British Columbia.

References: W. H. Powell, P. Philip, A. E. Foreman, H. L. Johnston, E. G. Matheson, C. C. Worsfold.

FOR TRANSFER FROM THE CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

COTTON—MILES PENNER, of Vancouver, B.C. Born at Kingston, Ont., June 14th, 1878. 1897-98, rodman and instr'man., C.P.R., Crows Next Pass and B.C. Southern Branches; 1898-1900, material agent and forwarder, Columbia and Western and Balfour Branches and Man. Branch lines; 1900-01, leveller, Atikokan Waskado, Snow flake Raleigh and Snowflake Valley Surveys; 1901 (July-Nov.) res. engr., constrn., Waskado Snowflake Branches; Nov. 1901, transitman, change main line Red Sucker North Shore Lake Superior; 1901-02, leveller, Raleigh Survey; 1902 (Mar.-April) leveller, Grade Reduction, Moose Jaw to Swift Current; 1902 (Apr.-Dec.), res. engr., Snowflake, Wellword and Yorkton extensions, track and bldgs.; 1903 (Jan.-Mar.), transitman on grade reduction Fort William to Winnipeg, and Mar,-Apr., res. engr. on same; 1903, asst. engr., Pheasant Hills Extension; 1904-06, asst. engr. in chg. track constrn.; 1906, contracting rly. constrn.; 1907, supt. constrn. V.V. & E. Rly., Great Northern; 1908 to date, engr. and contractor, Vancouver, B.C.

References: W. F. Tye, J. C. Sullivan, C. S. Gsowski, G. Grant, F. S. Keith.

DIMSDALE—HENRY GEORGE, of Edmonton, Alta. Born at Port Hope, Ont., Feb. 8th, 1876. 1889, asst. locating engr., Winona and So. Western Rly. in Minnesota, and res. engr. on constrn.; 1900, res. engr., Burlington Cedar Rapids and Nor. Rly. in Iowa and Minnesota; 1901-02, asst. divn. engr., mtce. of rly. and constrn. Chicago, Milwaukee and St. Paul Rly., Minnesota; 1903-04, res. engr., and locating engr., Louisville and Nashville Rly., in Kentucky and Tennessee; 1907-08, locating engr. and divn. engr., on constrn. Gt. Nor. Rly., Dakota and Montana; 1905-06, locating engr. and divn. engr., on constrn., C.P.R., Ont.; 1909-11, terminal engr. and divn. engr., on constrn. G.T.P.Rly. in B.C. and Sask.; 1912, ch. engr., Alberta Suburban Rly.;1913-14, dist. engr. and chg. of surveys, Edmonton, Dunvegen and B.C. Rly., and A.G.W. Rly., Alberta; 1914, organizing, Columbia Central Rly.; 3 yrs. overseas; at present Commn. of Highways for the Province of Alberta.

References: B. J. Saunders, J. Callaghan, A. Ford, F. E. Emery, G. C. Dunn, R. S. L. Wilson.

GREENE—WILLIAM HARVEY, of Moose Jaw, Sask. Born at Toronto, Ont., Nov. 12th, 1886. Educ., C.E., Univ. of Toronto, '09; 1906 and '07, (summers), dftsman. on bridge design, C.P.R., divn. engr's. office of constrn., Toronto; 1908 (summer), shaft and tunnel rock excavation on mining exploration project in Northern Ontario; 1909, distr. engr., on irrigation constrn. in Montana, U.S.A., and on railroad constrn. for Burlington system near Great Falls, Montana, with W. A. B. Cook & Co., railroad contractors; 1910, engr. in chg. party investigating Moose Jaw River as a source of water supply for City of Moose Jaw, work done by Irrig. Br., Dept. of Interior, Calgary, Alta.; 1911, investigation stream flow under ice cover in So. Alberta and engr. in chg., precise levelling party, Cypress Hills, Sask.; 1912-20, asst. city engr., design constrn. and mtce. of all public works, reinforced concrete subway, sewage disposal works, reinforced concrete dam and highway bridge combined, incineration plant, sidewalks, sanitary sewers, mech. filtration plant, water supply project etc., Moose Jaw, Sask.; 1921 and 1922, acting city engr., supt. of waterworks and bldg. inspectr., chg. all sanitary and storm sewers, high pressure fire system, incinerator, sidewalks, pavements, roads, bridges, subways etc., Moose Jaw, Sask.

References: G. D. Mackie, J. R. C. Macredie, L. A. Thornton, A. C. Garner, H. S. Carpenter.

HUNTER—JAMES HENDERSON, of Westmount, Que. Born at Sorel, Que., April 29th, 1865; Educ., Montreal High School; 1881-82, C.P.R.; 1883-84, Montreal Harbour Commissioners; 1885-87, Wood, Santon & Co., hydraulic and elect. engrs., New York; 1889-92, B. & O. Rly. stations, Island Rapid Transit Rly., constrn. and elect. signal work; 1893, Danbury Elec. Light and Power Co.; 1894-95, chg. of Saguenay River improvements; 1895 to date, consltg. engr., designed and constructed the following work — Boston Rubber Co., St. Jerome, St. Jerome Elec. Light Co. (original plant), North River Power Co., Wiaiton Binder Twine Co. Works, Waterville Elec. and Power Co., plans for Sault St. Louis Light and Power Co., unloading plant and coal packets for Dom. Coal Co., Cardinal Elec. Light and Power Co., Fort William Starch plant, 900' Concrete dock and grain elevator at Fort William, rebuilt Canada Starch Co. plant, Cardinal, designed and constructed number reinforced concrete industrial bldgs., and other concrete structures; at present, engr., Canada Starch Co., St. Paul Land and Hydraulic Co., and consltg. engr., Corn Products and Refinery Co., U.S.A.

References: R. E. Hunter, R. Bickerdike, F. Thomson, C. Thomson, F. P. Shearwood, R. Beausoleil.

ROBB—CHARLES ALEXANDER, of Edmonton, Alta. Born at Amherst, N.S., Jany. 28th, 1888. Educ., B.Sc., (M.E.), McGill Univ., '09, S.M., Mass. Inst., of Tech., '10; appr'tce., Robb Engr'g. Works, Ltd., Amherst, N.S. 1904-05, engr'g. student, Allis Chalmers, Ltd.; 1910-11, West Allis Works, Wisconsin; 1911 (part), designer, R. E. Wks.; 1911-12, asst. mech. engr., dept. Mass. Inst. Tech.; 1912-14, lecturer in mech. engr'g., University of Alberta, Edmonton; 1914-16, asst. Prof., mech. engr'g., and res. engr., Univ. of Alta., Edmonton; 1916-17, in chg. gauge production branch, Divn. of Gauges and Standards, Imperial Ministry of Munitions; 1917-19, tech. asst. to U.S.A. repres., Imperial Munitions Board (Canada), and mech. engr., Canadian War Mission, Washington, D.C.; 1919-20, Assoc. Prof. of mech. engr'g. and res. engr., Univ. of Alberta; to date, Prof. of Mech. Engr'g., and Res. Engr., Univ. of Alberta, Edmonton, Alta.

References: R. J. Durley, H. O. Keay, G. R. MacLeod, J. Chalmers, D. W. Robb, S. J. Fisher.

THERIAULT—LOUIS LEON, of 306 Brunswick Str., Fredericton, N.B. Born at Grandanse, Gloucester Co., N.B., Sept. 7th, 1884. Educ., B.Sc., (Arts), Sacred Heart College, Caraquet, N.B., '05, B.Sc., (C.E.), Univ. of New Brunswick, '09, and N.B. L.S. '09; 1908, (May-Oct.), rodman, N.T.Rly.; 1909 (May-Nov.), constrn. engr. in chg. constrn., Albert Mfg. Co., Hillsboro, N.B.; 1909-11, N.B. L.S. on crown lands, harbour and pvte. surveys, Caraquet, N.B.; 1911-14, asst., D.L. Surveys, precise Geodetic, correction and base lines survey in the four western provinces; Dec./14-July/15, municipal engr., Bathurst, N.B.; 1915 (July-Dec.), inspect'g. engr., Bathurst waterworks and sewerage system constrn.; 1916-17, municipal engr., Bathurst N.B.; 1917-20, distr. highway engr., New Brunswick; 1920 (Mar.-Nov.), town engr., Edmonston, N.B.; 1920 to date, district highway engineer, Dept. of Public Works, New Brunswick.

References: B. M. Hill, A. R. Wetmore, C. M. Stevens, G. Stead, D. W. Burpee, M. W. Black, R. McManus.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

HENDERSON—JOHN ARCHIBALD HAMILTON, of 87 Cartier Str., Ottawa, Ont. Born at Smiths Falls, Ont., April 19th, 1895. Educ., B.Sc., Queen's Univ., '22; 1912-16, with Geodetic Survey as follows—1912, rodman and recorder, precise levelling, 1913, Ottawa vicinity survey, levelling, triangulation, photography, plane table, 1914, asst. primary triangulation, 1915, baseline measurement and asst. primary triangulation, 1916, asst. primary triangulltion; 1917-19, overseas, Can. Engrs., B.E.F., France; 1920, in chg. reconnaissance, primary triangulation Saguenay River, 1921, observer, primary triangulation, British Columbia, and 1922, observer, primary triangulation B.C., for Geodetic Survey of Canada, Ottawa, Ont.

References: N. Ogilvie, G. A. Mountain, W. P. Wilgar, J. B. McRae, A. MacPhail, J. L. Rannie.

MICHELL—HUMPHREY GEORGE, of 152 Sevenoaks Ave., West Kildonan, Man. Born at Miniota, Man., Oct. 1st, 1894. Educ., B.Sc., (E.E.), Univ. of Manitoba, '20; 1913, (5 mos.), rodman location survey, G.T.P. Rly.; 1914 (3 mos.), elec. constrn., Manitoba Rolling Mills, Selkirk, Man.; 1916-19, overseas; 1919 to date with Winnipeg Hydro-Electric System as follows:— 1919 (June-Sept.), asst. operator; 1920-22, engag'd. testing and inspectn. overhead and underground lines, transformers, etc., survey and mapping of distribution system, on engineering staff; to date, distribution engr., designing and estimating, etc.

References: E. V. Caton, C. A. Clendenning, N. M. Hall, E. P. Fetherstonhaugh, J. W. Sanger.

MOORE—ULRIC ROBERT, of 257 Bridge Str., Niagara Falls, Ont. Born at Toronto, Ont., Sept. 27th, 1892. Educ., Grad. Tech. School, pvte. tuition, special course in surveying and engr'g., Toronto, and I.C.S. railroad éngr'g.; 1911 and '12, (summers) on location as rodman and leveller, and constrn., as rodman and instr'man., C.P.R.; 1913, asst. res. engr., constrn., C.P.R.; 1914-16, ch. dftsman., section 5, Welland Ship Canal; 1916-17, A/ office engr., and A/asst. engr.; 1917-19, Imperial Munitions Board, adjustor of claims, Ottawa; 1919-20, cost accountant, Tractor Corporation; 1920-21, asst. engr., design'g. dept., Toronto Harbor Commn.; 1921 to date, instr'man., divn. 4, power house constrn., Hydro-Electric Power Commission, Niagara Falls, Ont.

References: W. H. Sullivan, E. L. Cousins, G. T. Clark, W. Jackson, A. C. D. Blanchard, O. Holden, J. A. Hesketh.

THURBER—GEORGE HENRY, of St. John, N.B. Born at Harcourt, N.B., Feb. 25th, 1892; Educ., Nova Scotia Tech. Coll., '11; 1907 (one month), assisted in wiring and install'g. elec. lighting plant, in mfg. plant; 1910 (Aug.-Sept.), student asst., conducted 3 small surveys and made plans of same; 1911 to date, junr. engr., making surveys, plans,designs, estimates and reports on dredging and harbour works,inspecting and supervising constrn. of same, 1912-13, channel dredging, N. W. Miramichi River, 1913-14, constrn. of wharf at Little Lameque, N.B., 1913, hydrographic survey, Miscon Gully, N.B., 1914, hydrographic surveys N.W. and S.W. Miramichi Rivers, 1921-22, investigations with a view to establishing low-water datum, Miramichi River, Dept. of Public Works, Canada, St. John, N.B.

References: G. Stead, F. G. Goodspeed, G. E. Martin, H. F. Bennett, F. M. Dawson, K. G. Chisholm, G. S. Stairs.

WHITMAN—CLYDE OLIVER, of 772 St. Urbain Str., Montreal, Que. Born at New Albany, Annapolis Co., N.S., May 14th, 1889. Educ., B.Sc., N.S. Tech. Coll., '21; 1910-14, rodman and inspectr., maintenance dept., C.P.R., Lake Superior Divn.; 1916 (summer), instr'man., preliminary survey, Cape Split Hydro electric project, Bay of Fundy, N.S.; 1917-19, instr'man., Algoma Steel Corpn., Sault Ste. Marie, Ont.; 1920 (May-Sept.), asst. res'. engr., constrn. St. Margaret's Bay hydro-electric development, N.S.; 1921-22, on valuation N.S. Tramways and Power Co's. property, with Jackson and Moreland, Boston, Mass.; at present, asst. master, Baron Byng High School, 1251 St. Urbain Str., Montreal, Que.

References: F. R. Faulkner, B. E. Barnhill, N. L. Somers, W. W. Benny, C. H. Mitchell, R. A. Spencer, A. Sutherland, W. G. Hardy.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

DUGUID—ARCHER FORTESCUE, of Ottawa, Ont. Born at Bourtie, Aberdeenshire, Scotland, Aug. 1st, 1887. Educ., B.Sc., McGill Univ., '12 and Fettes College, Edinburgh, Scotland; 1908 (summer), chainman, G.T.P. constrn. on main line, Prince Rupert, B.C.; 1909 (summer), rodman, G.T.P. location, Biggar-Battleford, Sask., branch line; 1910, passed War Office exam. for univ. candidates for the British Army; 1912-14, Canadian Northern Mackenzie and Mann Montreal Tunnel and Terminal Co., Ltd.,— May-Sept./12, rodman, constrn. C.N.R. tunnel through Mount Royal, Sept.-Nov., levelman, Nov./12-Dec./13, transitman, Dec.-Aug./14, in chg. field, survey parties, responsible for all survey work; 1914-15, Lieut. C.F.A., France; 1915-16, Capt. C.F.A., England and France; 1916-17, A/Major, C.F.A., France; 1917-18, Brigade Major, 2nd Can. Divn. Arty. France; 1914-18, engaged in writing the history of the Canadian Forces in the Great War; 1918-19, General Staff Officer, grade 2, 3rd Can. Divn., France; 1919-21, on staff of Can. War Narrative Section, France, England and Canada; 1921 to date, Colonel on staff, Director of the Historical Section, General Staff, Militia Headquarters, Ottawa, Ont.

References: J. C. Kemp, E. Brown, J. L. Busfield, A. S. Dawes, H. F. H. Hertzberg, E. P. Fetherstonhaugh, H. M. MacKay, A. G. L. McNaughton, J. L. R. Parsons, K. M. Cameron.

FOX—EDWARD CECIL EVANS, of Toronto, Ont. Born at Coaticook, Que., Nov. 29th, 1899. Educ., Diploma (Mech. Engr.), I.C.S., '22; Lieut. in chg. no. 4, Section, 8th Field Company, Canadian Engrs., Toronto; 1918-20, appr'tce. engr., machine shop, inspecting office and engr'g. dept., Can. Ingersoll Rand, Sherbrooke, Que.; 1920-22, asst. to res. engr., on rly. location and constrn., Quebec Central Rly.; 1922, (Jan.-May), asst. and dftsman., A. R. Denison, C.E., archt'l. engr., Toronto, Ont.; May 1922 to date, dftsman., structural steel, bridges etc., McGregor and McIntyre, Toronto, Ont.

References: J. W. Harkom, E. T. Bridges, A. R. Robertson, E. C. Kirkpatrick, W. A. M. Cook.

NARRAWAY—ATHOS MAXWELL, of Ottawa, Ont. Born at Ottawa, Ont., July 19th, 1888. Educ., B.Sc., McGill Univ., '10; one year rly. constrn. dftsman., rodman and chainman, one year steel constrn.; 1910, articled pupil, Dom. and Ont. Land Surveys; 1911-12, D.L.S. commn., asst. Dom. Land Baseline Survey; 1913-15, ch. of party, Inspection Surveys; 1917 to date, Controller of Surveys, chg. of all field work for Topographical Surveys Branch, Dept. of the Interior, chg. Division Land Classification Surveys, chg. relief maps constrn., chg. soils testing laboratory.

References: T. Shanks, N. J. Ogilvie, G. H. Blanchet, F. H. Peters, G. B. Dodge, F. V. Seibert, J. E. N. Cauchon.

PYBUS—RALPH CARR, of 124 Matheson Ave., Winnipeg, Man. Born at Winnipeg, April 13th, 1900. Educ., B.Sc., (C.E.), Univ. of Manitoba, '22; 1919 (May-Oct.) Manitoba Good Roads, Munic. of Springfield; 1920 (May-Oct.), dftsman, G.T.P. Rly., Winnipeg Office; 1921 (May-Oct.), instr'man., and in chg. of road constrn., Manitoba Good Roads, Munic. of Springfield; 1922 (May-Sept.), dftsman. and inspectr. and in chg., during absence of distr. engr., work covering design and reinforced inspectn. concrete bldgs., C. A. P. Turner Co., consltg. engrs., Winnipeg, Man.; at present demonstrator in civil engr'g., Univ. of Manitoba, Winnipeg, Man.

References: J. N. Finlayson, P. I. Baker, E. P. Fetherstonhaugh, N. M. Hall, C. F. Cameron.

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A

ABRASIVE WHEELS

SELECTION OF. The Proper Selection of Grinding Wheels, P. N. Cooke. Can. Machy., vol. 26, no. 15, Oct. 13, 1921, pp. 25-28. Development and advan- [illegible]

ACCOUNTING

[illegible] eers, Arthur L. Mullergren. Eng. News-Rec., vol. 87, no 17, Oct. 27, 1921 pp. 685-687, 3 figs. Arguments for keeping books with segregated costs. Details of looseleaf system. Forms for expense vouchers and time distri- [illegible]

[illegible]

[illegible]

AIR CONDITIONING

[illegible] no. 2910, Oct. 7, 1921, pp. 518-519, 20 figs. partly on supp. plate. Describes [illegible]

AIRCRAFT CONSTRUCTION MATERIALS

SPRUCE. Investigation of Crushing Strength of Spruce at Varying Angles of Grain. Air Service Information Circular, vol. 3, no. 259, July 15, 1921, 15 pp. 10 figs. For determination of crushing or compressive strength from 0 to 90 deg.

AIRPLANE ENGINES

DEVELOPMENTS. Aero Engines, Alan E. L. [illegible] no. 3591, Sept. 16, 1921, pp. 725-740, 2 figs. Discusses thermodynamical, mechanical and metallurgical progress made in construction of aeroengines; stratified working, regeneration, bearing loadings and load factors, two-cycle engines, etc.

ALLOY STEELS

CARBON AND [illegible] Steels: Their Selection and Use, P. W. [illegible] Practical Eng., vol. 64, no. [illegible] Sept. 15, 1921, p. 167.

HARDENING. The Hardening of Tool Steel, S. N. Brayshaw. Eng. Production, vol. 3, no. 57, Nov. 3, 1921, p. 415. Results of work carried out by means of test bars and test cutters for purpose of determining effect of various annealings or heat treatments. (Abstract). Paper read before Sheffield Assn. Metallurgists & Metallurgical Chemists.

HIGH-RESISTANCE. Non-Magnetic, Flame-, Acid-and Rust-Resisting Steel. Chem. & Met. Eng., vol. 25, no. 17, Oct. 26, 1921, pp. 797-799, 5 figs. New high alloy steels developed in research laboratory of Crucible Steel Co. which can easily be worked and machined, but after heat-treatment become hard and resistant to attack of all agents.

ALUMINUM

PROPERTIES AND ALLOYS. Aluminum, Its Production, Properties and Alloys (L'aluminium, sa fabrication, ses propriétés, ses alliages), Léon Guillet. Revue de Métallurgie, vol. 18, no. 8, August 1921, pp. 461-526, 70 figs. Report of lecture at recent aluminum exposition. Appendixes giving curves for binary alloys. Bibliography.

ALUMINUM ALLOYS

AUTOMOBILE CONSTRUCTION. Use of Wrought Aluminum Alloys in Automobile Construction, Walter Rosenhain. Automotive Industries, vol, 45, no. 18, Nov. 3, 1921, pp. 862-864. Discusses advantages and possible applications, piston difficulties, corrosion.

BRONZES. Notes on Casting Aluminum Bronze, Austin D. Wilson, Foundry, vol. 49, no. 20, Oct. 15, 1921, pp. 801-804, 27 figs. Micrographs illustrate effects of different composition and heat treatments on structure. Presence of manganese tends to refine grain.

CASTINGS, CRACKS IN. Cracks in Aluminum-alloy Castings, Robert J. Anderson. Trans. Am. Inst. Min. & Metallurgical Engrs., no. 1104-N, Oct. 1921, 22 pp also (in abstract) Min. & Metallurgy, no. 168, Oct. 1921, pp. 43-44. Effects of various factors on cracking; method of molding; prevention of cracks.

See also Aluminum, [illegible]

ANEMOMETERS

TESTING. Measurement of Air Velocities and the testing of Anemometers, James Cooper. Iron & Coal Trades Rev., vol. 103, no 2798, Oct. 14, 1921, p. 540. Discusses results obtained with a testing anemometer table based on that designed by H. Briggs many years ago and which is claimed to work perfectly.

ASH HANDLING

CONVEYOR. A new Ash Handling Conveyor. Eng. & Indus. Management, vol. [illegible] developed by Underfeed Stroker Co., Ltd., London.

AUTOMOBILE ENGINES

[illegible] How Ford Cylinder Blocks are Cast, Pat. Dwyer. Foundry, vol. 49, no. 19, Oct. 1, 1921, pp. 751-758, 7 figs. New River Rouge plant operated on continuous production principle; to make castings for 8,000 cars per day. Description of making cores, molds, pouring castings, melting equipment, etc.

[illegible] cylindres en ligne), A. Contet. La Vie Automobile, vol. 17, no. 738, Sept. 25, 1921, pp. 335-339, 12 figs. Discusses variations of eight-cylinder crankshafts and describes Panhard, Fraschini and other eight-cylinder engines.

AUTOMOBILE FUELS

COKE. Coke As a Fuel for Commercial Vehicles, Thomas Clarkson. Engineering, vol. 112, no. 2912, Oct. 21, 1921, pp. 579-580. Points out that when coke is used a motor fuel, either for raising steam or making gas, cost of transport may be very considerably reduced as compared with gasoline motor. Paper read before Instn. Automobile Engrs.

AUTOMOBILES

CAMSHAFTS. Manufacture of Accurate Camshafts, Edward K. Hammond. Machy. (N. Y.), vol. 28, no. 3, Nov. 1921, pp. 175-180, 8 figs. party on p. 181. Describes important operations, and gives complete tabulated data on manufacturing procedure in making camshafts in Lincoln Motor Co's plant.

[illegible] 1921, pp. 7-11, 2 figs. [illegible] speeds, elastic constants of springs.

AVIATION

[illegible] 17 [illegible] 17 and [illegible]

B

BALLOONS

[illegible] speed of bringing down the balloon, winding cable, etc.

BEAMS

Continuous. Calculations for Continuous Beams with Third-Point Loading, Ewart S. Andrews. Concrete & Constructional Eng., vol. 16, no. 10, Oct. 1921, pp. [illegible] Mech. World. vol. 70, no. 1813, Sept. 30, 1921, pp. 266-267, 7 figs. Discusses Clapeyron's theorem of three moments.

Curved. Bending Lines of Curved Beams (Biegungslinien ringförmiger Trager), Friedrich Düsterbehn. Eisenbau, vol. 12 no. 10, Oct. 11, 1921, pp. 294-264 7 figs. Bending lines are developed for deformation of curved beams.

Sections. [illegible] Section, Alan Pollard. Machinery (Lond.)vol. 19, no. 473, Oct. 20, 1921, pp. 63-66, 4 figs. Method for determining the centroid, moment of inertia, swing radius, and moduli for any shape of section on drawing board.

BEARING METALS

Properties. What Metals Serve Best in Bearings-, Bruno Simmersbach. Raw Material, vol. 4, no. 9, Sept 1921, pp. 316-320. Relation between physical-chemical properties of bearing alloys and their ability to live under strenuous duty. [illegible] Zeitung.

BEARINGS, BALL

Roller and. Anti-Friction Bearings in the Steel Mill, A. M. MacCutcheon. Blast Furnace & Steel Plant, vol. 9, no. 10, Oct. 1921, pp. 600- 607, 13 figs. Discusses ball and boiler bearings, their manufacture, mounting and selection. Advantages and disadvantages of anti-friction bearings. (Abstract). Paper read before Iron & Steel Elec. Engrs.

BEARINGS, ROLLER

Tangential Load. Experiments with Roller Bearings Under Tangential Load (Undersökningar rörande rullning under tangentialkraft), Arvid Palmgren. Teknisk Tidskrift (Mekanik), vol. 51, no 9, Sept. 14, 1921, pp. 129-132, 8 figs. [illegible]

BELTING

[illegible] H Rudeloff. Zeit. des Vereines deutscher Ingenieure, vol. 65, no. 40, Oct. 1921, pp. 1041-1044, 4 figs. Account of test to determine strength of paper [illegible] of manufacture, for purpose of ascertaining degree to which strength of cellulose employed in yarns, textures and belts is utilized.

Rubber. Getting the Maximum Service in Rubber Transmission Belting, James B. McPherson. Chem. & Eng. News, vol. 33, no. 10 Oct. 1921, pp. 29-30. Writer advises securing maximum coefficient of friction, maximum arc of contact practicable, avoiding excessive tension, reckless use of dressings, and [illegible]

BLAST-FURNACE GAS

Steam Power from. Steam Power from Blast-Furnace Gas, Gordon Fox and F [illegible] 15, 1921, pp. 7[illegible], 3 figs. Resumé on utilization of blast-furnace gas for steam making and development in burning gas alone or in combinations with other fuels. Typical data are given [illegible] supply. Importance of clean-[illegible] are cited and developments [illegible]

BLAST FURNACES

High Top Heat. Causes of High Top Heat in the Blast Furnace, Wallace G. Imhoff. [illegible] Chart record-[illegible] are of value in controlling furnace operations, [illegible]

BOILER FEEDWATER

Concentration, Control of. Priming and Control. of Boiler Water Concentration, Geo. C. Cook. Power Plant Eng., vol. 25. no. 20, Oct. 15, 1921, pp. 986-988. Discusses limit of impurities in feedwater and methods of controling degree of concentration.

BOILER FIRING

Fuel Saving in. Fuel Saving in Relation to Capital Necessary, Joseph Harrington. Mech. Eng., vol. 43 no. 11, Nov. 1921, pp. 725-726, 2 figs. Investigation shows economy resulting from use of efficiency equipment. Concrete illustrations [illegible] support [illegible] Abstract.

BOILER PLANTS

Efficient Operation. Boiler-Plant Efficiency, Victor J. Azbe. Mech. Eng., vol. 43. no. 11, Nov. 1921, pp. 722-724 and 726, 5 figs. Usual wastes in boiler plants are brought out by means of tables and curves of boiler performance compiled from large number of observations. Shows to what extent these wastes are preventable or can be made to balance each other, and recommends standard for boiler operation toward which designers and operators may aim. Requirements of ideal boiler installation are summarized.

BOILERS

Design and Settings. Boiler Equipment at River Rouge Plant of the Ford Motor Company, George T. Ladd. Proc. Engineers' Soc. of Western Pa., vol. 37. no. 3 April 1921, pp. 115-148 and (discussion) 149-157, 17 figs. Discussions design of boilers and settings. Discussion of powdered coal equipment and superheater equipment by H. D. Savage and J. R. Le Vally, respectively.

Flanging Methods. Special Methods of Boiler Flanging, George A. Richardson. Boiler Maker, vol. 21, no. 10, Oct. 1921, pp. 281-283, 8 figs. Hand flanging and sectional presses used for irregular shapes in boiler and tank fabrication.

BOILERS, WATER-TUBE

Advantages. The Advantages of Walter Tube Boilers, James Kemnal. Mar. Eng. of Can. vol. 11, no. 9, Sept. 1921, pp. 22-23. Describes various cases where cylindrical boilers were replaced by water tube boilers.

BRAKES

Air-Westinghouse. New Tests of the Westinghouse Continuous Air Brake (Nouveaux essais du frein continu système "Westinghouse"), M. Tête. Revue Générale des Chemins de Fer et des Tramways, vol. 40, no. 7, July 1921, pp. 22-50, 8 figs. Results of tests in France by commission appointed by Minister of Public Works are entirely satisfactory.

BRASS FOUNDRIES

Cast Ingots. The Casting of Brass Ingots, R. Genders. Metal Industry (Lond.), vol. 19, no. 14, Sept. 30, 1921, pp. 261-262, 2 figs. Describes experiments carried out to minimize occurrence of non-metallic inclusions.

BRICKMAKING

Brick-Handling System. A New System of Handling for Brick, Tile and Pottery Works. Eng. & Indus. Management, vol. 6, no. 16, Oct. 20, 1921, pp. 451-455, 12 figs. Describes new system patented by Hirt & Cie., Paris, for conveying products from presses or other brickmaking machines to drying chamber, depositing them therein, and transporting them to kilns when sufficiently dry.

BRIDGE DESIGN

European and American Standards. American and European Bridge Standards, P.H. Chen. Eng. & Contracting, vol. 56, no, 17, Oct. 26, 1921, pp. 400-401. (Abstract.) Paper read before Assn. Chinese & Am. Engrs. with comments by J. A. L. Waddell.

BRIDGES, LIFT

Bascule. Putting Large Bascule in Service. Eng. News-Rec., vol. 87, no. 15, Oct. 13. 1921, pp. 606-607, 1 fig. Program for change to new structure across Chicago River involves minimum stoppage of street and elevated-railway traffic.

BRIDGES, RAILWAY

Impact Tests. Results of Impact Tests on Bridges in England. Eng. News-Rec., vol. 87, no. 16, Oct. 20, 1921, pp. 642-644, 2 figs. Photo-recording strain gage applied to 20 bridges yields 362 records. High-frequency vibration found expecially in floor systems. New formula proposed. Results of experiments to measure impact effects in railway bridges carried out during past year in England.

BUSSES

Interior Lighting. Interior Lighting of Busses, L. C. Porter and R. W. Jordan. Trans. Illuminating Eng. Soc., vol. 16, no. 5, July 20, 1921, pp. 77-94, and discussion, 111-116, 13 figs. Describes tests made with domes and tungsten filament lamps, also lighting units equipped with reflectors.

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CAR SHOPS

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CASTING

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CHAIN DRIVE

[illegible] Automotive Industries, vol. 45, no. 16, Oct. 20, 1921, pp. 773-778, 18 figs. [illegible]

[illegible]

BIBLIOGRAPHY. A Bibliography and Abstract of Chromium Steels. F. P. Zimmerli. Chem. & Met. Eng., vol. 25, no. 18, Nov. 2, 1921, pp. 837-843. Chronological [illegible]

COAL MINING

HYDRAULIC STOWING. Hydraulic Stowing, George Know and J. Drummond Paton. Iron & Coal Trades Rev., vol. 103, no. 2796, Sept. 30, 1921, pp. 463-466, 14 [illegible]

COFFERDAMS

[illegible] Eng. News-Rec., vol. 87, no. 20, Nov. 17, 1921, pp. 806-808, 7 figs. Trestle [illegible] N.B.

COKE

[illegible] Production, Distribution, and Uses of Coke. [illegible] 156, no. 3047, Oct. 5, 1921, pp. 37-38. Discusses use of coke as fuel and [illegible] 103, no. 2796, Sept. 30, 1921, p. 471.

COMBUSTION

[illegible] Arthur Haward. Proc. Roy Soc., vol. 100, no. A 702, Oct. 4, [illegible] actual rate at which potential energy is transferred on explosion [illegible]

COMPASSES

GYROSCOPIC. The Gyro Compass for Surveyors. Min. Mag., vol. 25, no. 4, Oct. 1921, pp. 220-222, 2 figs. Description of Anschütz gyro compass (made [illegible]

CONCRETE

[illegible] Weather. Tokujiro Yoshida. University of Ill., vol. 18, no. 35, May 2, 1921, 55 pp., 19 figs. Account of experiments furnishing test data on length of time required for concrete of given temperature to lose its heat and become cold [illegible]

ROAD. Laboratory Control of Concrete. H. S. Mattimore. Can. Engr., vol. 41, no. 17, Oct. 27, 1921, p.l. Enumerates factors regulating proportion of mix; [illegible]

SAND [illegible] Concrete. Cem. & Eng. News, vol. 33, no. 11, Nov. 1921, pp 21-24. Review [illegible] for Ind. Sand & Gravel Producers' Assn.

STRENGTH, EFFECT OF AGE ON. Effect of Age on Strength of Concrete for High- [illegible] figs. Criticism of report of tests made on concrete used in California highways. Tests show that age increases strength of concrete when in contact with moisture.

CONDENSERS, STEAM

NEW TYPE HIGH EFFICIENCY. Steam-Consending Plants, Paul A. Bancel. Mech. Eng., vol. 43, no. 11, Nov. 1921, pp. 711-716 and 758, 14 figs. Detailed consi- [illegible] and description of new type of high efficiency condenser.

CONDUITS

[illegible] Sewer Tunnels, Julian Hinds. Eng. News-Rec., vol. 87, no. 17, Oct. 27, 1921, pp. 693-694. Presents tables giving head and discharge at critical depths and static pressures in circular and horseshoe conduits partly full.

CONVEYORS

PULVERIZED MATERIALS. Pulverized-Material Conveyor System. Power, vol. 54, no. 17, Oct. 25, 1921, pp. 628-629, 4 figs. Describes the Fuller-Kinyou conveying system for pulverized material, comprising a power-driven pump function of which is to start the mass in motion; source of compressed-air supply and a pipe through which material flows.

TYPES. [illegible] Terry. [illegible] and 301-302. Oct. 7: Dicsusses bucket elevators and worm or Archimedean screw conveyors. Oct. 14: Discusses band Zimmer, gravity and peunmatic conveyors. Paper read before Belfast Assn. of Engrs.

[illegible]

COPPER ALLOYS

CUPRO-NICKEL. Manufacture of Cupro-Nickle, Herbert D. Swift. Metal Industry (N. Y.), vol. 19, no. 10, Oct. 1921, pp. 394-395. Description of process going in regular order from casting to packing.

CORROSION

ELECTROLYTIC. Electrolytic Corrosion of Lead Thallium Alloys, Colin G. Fink and Charles H. Eldrige. Am. Electrochem Soc., advance paper, no. 26, for meeting Sept. 29-Oct. 1, 1921, pp. 335-344, 4 figs. Shows that addition of thallium to lead alloys has been very effective in reducing anadic corrosion in acid copper sulphate electrolytic containing nitric and hydrochloric acids.

HEATING SYSTEM. Preventing Corrosion in Heating System, Perry West. Domestic Eng. (Chicago), vol. 97, no. 2, Oct. 8, 1921, pp. 50-53 and 82-84, 4 figs. Describes deoxidizing and de-aerating methods.

COST ACCOUNTING

CLASSIFICATION OF SURPLUS. Classification of Surplus. C. B. Couchman. Jl. of Accountancy, vol. 32, no. 4, Oct. 1921, pp. 265-278. Discusses various kinds [illegible] Paper read before Am. Inst. of Accounts.

UNIFORM MILL SYSTEMS. Uniform Mill Cost Systems, C. Oliver Wellington. Paper, vol. 29, no. 6, Oct. 12, 1921, pp. 13-15. Discusses advantages of uniformity in cost accounting.

COSTS

MATERIAL RECORDING. The Recording of Material Costs, E W Workman. Eng. & Indus. Management, vol. 6, no. 16, Oct, 20. 1921, pp. 426-427. Describes method of dealing with material charges which has been found to work exceptionnally well in large engineering firm using Hollerith system for dealing with its labor and overhead expenses.

CRANES

BRIDGE. New Type of Bridge Crane for Handling Sand and Gravel, W. A. Scott. Cem., Mill & Quarry, vol. 19, no. 8, Oct. 20, 1921, pp. 27-28, 2 figs. Has max. length of 184 ft.; clamshell busket has capacity of 3 yd.; carriage speed, 800 ft.; per min.; bucket speed 200 ft.

CRANKCASES

MALLEABLE-IRON. Crank Cases Made of Malleable Iron. Foundry, vol, 49, no. 19, Oct. 1. 1921, pp. 762-766, 10 figs. An extensive series of experiments in molding and in subsequent heat treatment was required before castings were produced on a commercial basis

CUTTING METALS

UNIVERSAL OXYGEN-JET. A universal Oxygen-Jet Cutting Machine. Eng. Production, vol. 3, no. 56, Oct. 27, 1921, pp. 395-397, 3 figs. Details and uses of machine by Godfrey Eng. Works, London.

D

DIES

AUTOMOBILE PARTS. Making Dies for Forming Automobile Parts, Richard Dale. Iron Age, vol 108, no 18, Nov 3, 1921, pp 1127-1129, 10 figs Explains design and construction for manufacture of such articles zs brake drums and step brackets.

SHAVING TOOLS. Notes on the Design of Shaving Tools, Hugo F. Pusep. Am. Mach., vol. 55. nos. 16 and 17, Oct. 20 and 27, 1921, pp. 624-626 and 686-689, 18 figs. Second operation necessary to obtain accuracy of size and contour. Discusses three general classes of shaving tools.

WIRE-DRAWING DIAMOND. Diamond Dies for Wire Drawing, C. W. Busick. Am. Mach., vol. 55, no. 18, Nov. 3, 1921, pp. 703-705, 7 figs. How dies are lapped and tested for size. Automatic lapping machines for this work.

DIESEL ENGINES

COMBUSTION IN. Explosion and Internal-Combustion Engines (Moteurs à Explosion et à Combustion Interne), F. Huard. Arts et Métiers, vol. 74, no. 11, August 1921, pp. 242-246, 2 figs. Discusses combustion in Diesel and semi-Diesel engines. (Concluded.)

MARINE. Building Marine Diesel Engines. Eng. Production, vol. 3, nos. 53 and 54, Oct. 6 and 13, 1921, pp. 321-325 and 349-352, 21 figs. Methods and equipment of the North British Diesel Engine Works, Ltd., at Glasgow, founded in 1913 for purpose of developing marine Diesel engine up to 12,000 hp.

The Marine Diesel Engine: Its Reliabily in Service, Andrew J. Brown. Trans. Inst. Mar. Engrs., vol. 33, Sept. 1921, pp. 297-307 and (discussion) 307-325, 7 figs. Discusses the various parts of engine from the standpoint of showing how reliability is ensured.

WORTHINGTON SOLID-INJECTION. The Worthing Solid-Injection Diesel. Power, vol. 54, no. 18, Nov. 1, 1921, pp. 675-677, 3 figs. Engine operating on Diesel cycle without air injection. Novel means employed to secure combustion at constant pressure with pump feed.

DROP FORGING

MODERN PRACTICE. Modern Drop-forging Practice, Fred R. Daniels. Machy. (N. Y.), vol. 28, no. 3, Nov. 1921, pp. 213-217, 8 figs. Comparison of drop forgings and castings, and general methods of making them.

DRYING

CHRONOLOGICAL SURVEY. A Chronological Survey of Drying and Dryers, J. E. Bolling. Jl. Am. Soc. Heating & Ventilating Engrs., vol. 27, no. 7, Oct. 1921, pp. 715-738, 19 figs. Notes on heating and moisture-removal methods; evolution of the compartment dryer; efficiency of dryers.

E

ELECTRIC CURRENT

GROUND DETECTORS. Ground Detecting Devices, Victor H. Todd. Power Plant Eng., vol. 25, no. 20, Oct. 15, 1921, pp. 994-997, 12 figs. Dicsusses single-phase and three-phase ground detectors, electrostatic voltmeters and glow-meters, etc.

ELECTRIC DRIVE

LUMBER MILLS. Application of Electrical Energy in Lumber Mills, W. A. Scott. [illegible] Nov. 5, 1921, pp. 685-688, 6 figs. Saws, conveyors and other units driven by belted and direct-connected motors; [illegible] lumber industry, mill refuse as fuel to generate [illegible] power

ELECTRIC FURNACES

GRAY-IRON CASTINGS. Gray Iron Castings from Electric Furnaces. Thomas Robson Hay. Iron Age, vol. 108, no. 19, Nov. 10, 1921, pp. 1214-1215. Present electric practice and advantages over older method. Comparative cost.

INDUCTION. A New Electric Induction Furnace (Nouveau four électrique à induction), H. Vigneron. La Nature, no. 2475, Sept. 10, 1921, pp. 163-165, 5 figs. Describes Northrup system and its applications.

IRON INDUSTRY. Electric Furnace Possibilities in the Western Iron Industry, R. C. Gosrow. Jl. Electricity & Western Industry, vol. 47, no. 7, Oct. 1, 1921, pp. 265-266. Analysis of opportunities open to the electric furnace in the Western iron industry, with data on costs.

REPELLING-ARC TYPE. Something New in Electric Furnaces, E. F. Cone. Sci. Am. vol. 125, no. 14, Oct. 1, 1921, p. 229, 1 fig. Describes repelling-arc type of furnace having a self-regulating, flaming arc torch.

SUPERHEATING IRON. Superheating Iron Electrically, George K. Elliott. Iron Trade Rev., vol. 69, no. 16, Oct. 20, 1921, pp. 1007-1011. States that by using basic-lined electric furnace in conjunction with cupola, high-temperature iron can be produced, desulphurization can be accomplished easily and impurities closely controlled. Compares composition and strength. Paper presented under auspices of Am. Foundrymen's Assn. before Inst. British Foundrymen.

ELECTRIC LOCOMOTIVES

CHARACTERISTICS. Characteristics of the Electric Locomotive, N. W. Storer. Jl. Franklin Inst., vol. 192, no. 4, Oct. 1921, pp. 453-467, 8 figs. Deals with d.c. and a.c. locomotives, and regenerative braking.

COMPARISON WITH STEAM. Some Mechanical Characteristics of High-Speed, High-Power Locomotives, A. W. Gibbs. Jl. Franklin Inst., vol. 192, no. 4, Oct. 1921, pp. 469-495, 26 figs. Deals principally with results of comparative trial of steam and electric locomotives amde in 1907 to secure information in connection with design of electric locomotives for Pennsylvania terminal in New York.

CONTROL EQUIPMENT. Electrical Considerations Which Govern in a Choice of Locomotives for Any Given Class of Service, H. H. Johnston. Coal Age, vol. 20, no. 18, Nov. 3, 1921, pp. 717-719, 4 figs. Locomotives with dynamic braking controllers deliver current on descending grades and must have additional motor capacity. Series-and-parallel control vs. series-parallel control.

MIDI RAILWAY FRANCE. Mechanical Aspects of the New Electric Double-Bogie Locomotives of the Midi Railroad in France [Sur les dispositions mécaniques d'ensemble des nouvelles locomotives électriques à deux bogies moteurs (type de la compagnie des chemins de fer du Midi,] Fernand Broussouse. Le Technique Moderne, vol. 13, no. 3, March 1921, pp. 97-101, 12 figs. Discusses French and Amrrican suspensions, interchangeability and balancing of Midi bogies, etc.

SELECTION. Mechanical and Engineering Considerations Determining the Selection of an Electric Locomotive, H. H. Johnston. Coal. Age, vol. 20, no. 17, Oct. 27, 1921, pp. 679-681, 5 figs. Discusses mine-haulage equipment and their specifications, locomotives, speed, and weight of rail.

ELECTRIC PLANTS

BANGOR, ME. Remodeling Plant to Increase Rating, Phifer Smith Elec World vol. 78, no. 17, Oct. 22, 1921, pp. 815-818, figs. Describes new constructions at Veazie power plant of Bangor (Me.) Ry. & Electric Co., including four new units of 1,800 kw. capacity each.

BLACKBURN, ENGLAND. Electricity Supply in Blackburn. Electrician, vol, 87, no. 2267, Oct. 28, 1921, pp. 535-539, 3 figs. Describes coal and ash handling plants, boiler house, turbo-alternators (two 10,000 kw. each driving 6,600=volt 50-period three-phase alternators), and auxiliaries of new power station.

EDINBURGH. New Electricity Station at Edinburgh, S. B. Donkin. Electrician, vol. 87, no. 2263, Sept. 30, 1921, p. 407. Describes equipment, including generating plant, sea work pumps, shafts and tunnels. H. T. three-phase current; ultimate capacity 100,000 kn. (Abstract.) Paper read before British Assn.

LARGE UNITS. Some Notes on Large Electric Units, Stanley Parker Smith. Electrician, vol. 87, no. 2262, Sept. 23, 1921, pp. 378-380, 5 figs. Discusses prime movers, a.c. and d.c. production, converters, mercury rectifiers etc. (Abstract.) Paper read before British Assn.

LONDON UNDERGROUND RAILWAY. Chelsea Power Station—London Underground Railway. Tramway & Ry. World, vol. 50, no. 20, Oct. 20, 1921, pp. 185-189, 5 figs. Describes new equipment installed, including 15,000-kw. turbo-alternators, condensing water plant, etc.

REACTANCES, APPLICATION OF. The Application of Reactances to Large System, W. A. Coates. Beama, vol. 9, no. 4, Oct. 1921, pp. 330-334, figs. Describes the case where two existing stations are to be linked with a third new plant, by means of a high-voltage cable system.

SMALL. Economies in Operation of Small Power Plants, E. S. Hight, Elec. Rev., Chicago), vol. 79, no. 16, Oct. 15, 1921, pp. 573-576, 3 figs. Discusses selection of coal, reduction of air leakage and radiation losses, engine room economies, etc. Extracts from paper before Iowa section of N. E. L. A.

ELECTRIC RAILWAYS

THIRD-RAIL SYSTEM. Experiences of Northwestern Pacific Ry. with Third Rail System, C. E. Hatch. Eng. & Contracting, vol. 56, no. 16, Oct. 19, 1921, p. 380. Experiences in operation of 37 mi. of electrified track on which third-rail system is employed. Notes on how contact rail is supported; protections at crossings and stations; method of carrying feeders; and maintenance cost. (Abstract.) Paper read before Pac. Ry. Club.

ELECTRIC SWITCHES

Safety. Types, Construction and Application of Safety Switches. Elec. Rec., vol. 30 no. 5 Nov. 1921, pp. 341-349, 58 figs. Defines and classifies existing types of safety switches and gives details of their design and construction.

ELECTRIC TRANSMISSION LINES

California. Building a World's Record Transmission Line in the West, Robert Sibley. Jl. Electricity & Western Industry, vol. 47, no. 8, Oct. 15, 1921, pp. 301-303, 14 figs. Some of the problems of construction which have been overcome by western engineers in building the record 165,000-volt, 240-mile transmission line from Caribou plant to San Francisco.

Inductive Interference. Inductive as Seen by the A.R.A. Elec. World, vol. 78, no. 16, Oct. 15, 1921, pp. 767-769. Gives second section of report of Inductive-Interference Committee of Am. Ry. Assn., dealing with causes and effects.

Line-Loss Expense. Determination of Line-Loss Expense, P. O. Reyneau and H. P. Seelye. Elec. World, vol. 78, no. 16, Oct. 15, 1921, pp. 771-773, 1 fig. Can be based on equivalent hours of peak-load usage. Method of applying to a specific case. Corrections for special conditions. Range of value for equivalent hours.

ELECTRIC WELDING, ARC

Rail Joints. Arc Welded Rail Joints. Welding Engr., vol. 6. no. 10, Oct. 1921, pp. 27-32, 13 figs. Discusses welding rail joints by the Detroit street-car system and test made.

ELEVATORS

Electrical Troubles. Locating Electrical Trouble on Elevators, William Zepernick, Power, vol. 54, no. 20, Nov. 15, 1921, pp. 755-757, 14 figs. Grounds, short circuits and open circuits defined. Methods of grounding power systems. Examples given on how to locate electrical faults on controller equipment.

EMPLOYEES

Thrift Encouragement by Employers. Thrift Encouragement by Employers—V, Leonhard Felix Fuld. Indes. Management vol. 62, no. 5, Nov. 1921, pp. 287-289. Points out that investment companies appear to be ideal thrift encouragement plan for workers as they furnish a thrift encouragement vehicle for each class of worker.

EMPLOYEES, TRAINING OF

Selection and. Industrial Training and Selection of Personal, C. R. Dooley. Chem. & Met. Eng., vol. 25, no. 15, Oct. 12, 1921, pp. 692-695. Outline of basic principles underlying modern methods of selecting and training employees, and some helpful suggestions for solving personnel problems.

ENAMELING

Steel Containers. Enamel-Lined Apparatus, Chester H. Jones. Chem. & Met. Eng., vol. 25, no. 20 Nov. 16, 1921, pp. 927-932, 17 figs. Plant of Elyria Enameled Products Co. at Elyria, Ohio, engages in manufacture of enameled equipment for service in many varieties of plant processing; steel and cast-iron containers; burning equipment; composition and properties of enamels; control and management of operations.

EVAPORATORS

Design. An Improvement in Evaporator Design, Robert V. Cook. Chem. Age (N.Y.), vol. 29, no. 10, Oct. 1921, pp. 409-410, 1 fig. Describes the criss-cross evaporator.

Tests. Result of Operation With Some Evaporators (Résultats de marche de quelques appareils d'évaporation), M. Depasse. Bul. de l'Association des Chimistes de Sucrerie et de Distillerie vol. 38 no. 10. April 1921, pp.383-404 and (discussion) 407-409, 2 figs. Gives test data with two-stage, three-stage, and four-stage evaporators.

EXCAVATION, EARTH

Principles of. Fundamental Principles in Handling Earthwork, D. H. Sauerbraun. Can. Engr., vol. 41, no 16, Oct. 20, 1921, pp. 5 and 12. Notes on scraper system and rock-drilling equipment. Paper read at Highway Conference at University of Pa.

FACTORIES

Planning Operation. Notes on the Preparation of Work Lay Outs, H. Varley, Eng. & Indus. Management vol. 3, no. 57, Nov. 3, 1921, pp. 491-494, 9 figs. Writer enumerates points which should be carefully considered when a part is to be laid out in operations.

Rubber Tires. Mechanical Features of Tire Factory. Iron Age, vol. 108, no. 20, Nov. 17, 1921, pp. 1259-1265, 8 figs. New Kelly-Springfield plant is said to have unusually complete interconnection of mechanical services. Notes on tunnels, piping, wiring and communication.

FACTORY MANAGEMENT

See Industrial Management.

FANS, CENTRIFUGAL

Design. Controlling Factors in Fan Design, David Darrin. Heat & Vent. Mag., vol. 18, no. 10, Oct. 1921, pp. 49-52. Discusses required capacities available space and attendance, allowable first cost and operating cost, etc., and gives table of present standards of fan design.

Electrically Driven. Electrically Driven Centrifugal Fans for Mine Ventilation. Mech. World, vol. 70, no. 1815, Oct. 14, 1921, pp. 303-304. Discusses characteristics of fans and motors, power requirements, etc.

Heaters and. Fans and Heaters, Charles L. Hubbard. Southern Engr., vol. 36, no. 2, Oct. 1921, pp. 44-49, 12 figs. Working data for fans; fan drives; heaters; determining size of heater; heater arrangements; heater connections, ducts and flues.

FATIGUE

Industrial. Physiological Methods for Measuring Industrial Fatigue (Les Méthodes Physiologiques actuelles d'évaluation de la Fatigue dite "Industrielle") D. Gilbert. Annales des Mines de Belgique, vol. 22, no. 3, 1921, pp. 837-847, 1 fig. Concludes that present methods are not strictly applicable.

Reduction. Reducing Fatigue in Tool Rooms, F. B. and L. M. Gilbert. Iron Trade Rev., vol. 69, no. no. 16. Oct. 20, 1921, pp. 1004-1006. 7 figs. Orderly arrangement of tools, conveniently placed shelves and drawers, and white surfaces tend to improve conditions in tool crib. Ample sunlight inportant. (Abstract.) Paper before Soc. Indus. Engrs.

Tests. Fatigue Tests at Purdue University, George H. Shepard. Indus. Management, vol. 62, no. 5, Nov. 1921, pp. 281-286, 4 figs. How exertion and rest periods affect efficiency. Includes chart showing output in foot-pounds under certain conditions of work and rest periods.

FILING SYSTEM

Classification, Indexing and. Classification, Filing and Indexing System for Pulp and Paper Library, Carleton E. Curran. Paper, vol. 28, nos. 19, 20 and 21, July 13, 20 and 27, 1921, pp. 9-11, 23 and 30, —. 17-19 and pp. 17-18. Gives an adaptation of the Dewey classification..

FILTERS

Centrifugal. Centrifugal Filters, H. C. Beckman. Jl. Indus. & Eng. Chem., vol. 13, no. 11, Nov. 1921, pp. 992-993. Discusses those with perforated drum and those having an imperforate drum, and advantages of the latter. Paper read before Am. Chem. Soc.

Centrifugal. Discusion of Centrifugal Draining, T. A. Bryson. Jl. Indus. & Eng. Chem., vol. 13, no. 11, Nov. 1921, pp. 993-996, 3 figs. Discusses removing force, restraining force and resistance to motion, which are factors affecting drainage. Gives chart of centrifugal force per lb. of load. Paper read before Am. Chem. Soc.

FILTRATION

Filter Media. Industrial Filter Media, Arthur Wright. Jl. Indus. & Chem., vol. 13, no. 11, Nov. 1921, pp. 984-986. Discusses cotton cloths, properties affecting discharge of cake, media for corrosive materials, etc. Paper read before Am. Chem. Soc.

FILTRATION PLANT

Peterborough, Ont. New Filtration Plant at Peterborough, R. L. Dobbin. Can. Engr., vol. 41, no. 18, Nov. 3, 1921, pp. 1 and 4, 12 figs. Concrete dam across Otonabee River provides power for turbine-driven pumps. New filtration plant and 2,000,000-gal. concrete reservoir recently constructed. Five filter units built, six provided for.

FLOOD CONTROL

Pratt Porous Dam. Making the Flood Dam Itself, J. F. Springer. Sci. Am., vol. 125-A, no. 17, Nov. 1921, pp. 38-39, 3 figs. Describes simple wire netting structure that gathers mud, boulders and miscellaneous debris to form a barrier.

FLUE-GAS ANALYSIS

Testing Apparatus. Apparatus for Testing Flue-Gas, John B. C. Kershaw.. Combustion vol. 5, no. 5, Nov. 1921, pp. 204-207 and 218, 9 figs. Describes seven gas-testing instruments which depend upon the measurement of some physical property of waste-gases which also serves as an index of the amount of CO_2 contained in them.

FORGE PLANTS

Safety Guards in Shops. Using Safety Devices in Forge Shops. Iron Trade Rev., vol. 69. no. 19. Nov. 10, 1921, pp. 1216-1217, 6 figs. Decribes simple and inexpensive guards which are being used in one shop.

FOUNDATIONS

Steam Power Plants, etc. Some Notes on Foundation Plans, Douglas Wilson. Mech. World, vol. 70, no. 1816, Oct. 21 1921, pp. 327-328, 6 figs. Discusses foundations for prime movers, steam power installations, steam turbines, concrete and reinforcement.

FOUNDRIES

Steel. Famous British Works. Eng. Production, vol. 3. no. 54, Oct. 13, 1921, pp. 338-339, 2 figs. Details of plant and equipment of steel foundry of Edgar Allen & Co., Ltd., Tinsley for production of high-speed, carbon and alloy tool steels, special alloy steels for automobiles and aircraft, toughened steel castings for engineering and other purposes, dynamo magnet-steel castings, Imperial manganese steel etc.

TEMPERATURE PROBLEMS. Temperature Problems in Foundry and Melting Room, John P. Goheen. Trans. Am. Inst. Min. & Metallurgical Engrs., no. 1105-N 1921, 5 pp. Notes on pyrometer equipment for electric brass-melting furnace; special equipment for brazing brass; core-oven temperature control; and value of annealing. Abstract in Min. & Metallurgy, no. 179, Nov. 1921, p. 36.

FREQUENCY

ZERO MEASURING METHOD. A Frequency-Bridge, Edy Velander. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 11, Nov. 1921, pp. 835-839, 3 figs. Apparatus for accurate determination of frequency, by means of a null method.

FUELS

GASEOUS. Gaseous Fuel in the Shipbuilding World, George Keillor. Gas Jl., vol. 156, no. 3047, Oct. 5, 1921, pp. 34-37. Discusses application in annealing, hardening and normalizing. Billet, plate and rivet heating; core and mold drying; fuel consumption. See also Iron & Coal Trades Rev., vol. 103, no. 2796, Sept. 30, 1921, pp. 476-478.

SMOKELESS, MANUFACTURE OF. The Manufacture of Smokeless Fuel. Engineering, vol. 112, no. 2913, Oct. 28, 1921, pp. 596-601, 41 figs., partly on supp. plate; also Engineer, vol 132, no. 3435, Oct. 28, 1921, p. 464, 3 figs. Describes works of low Temperature Carbonisation, Ltd., Barugh, England which has 20 retorts in continuous service and are carbonizing 36 tons of coal daily. Fuel produced is sort of semi-coke carrying only very small proportion of breeze and is called coalite.

[*See also Oil Fuel, Pulverized Coal.*]

G

GAGES

PRECISION. Precision Gauges, M. E. Kanek. Mech. World, vol. 69, no 1782, Feb. 25, 1921, pp. 139-141. Discusses 81-block sets, types on the market, effect of size on a accuracy, material for gages, direct and comparative methods of measuring, etc.

SNAP. Systems of Gauging. Eng. Production, vol. 3, no. 54, Oct. 13, 1921, pp. 345-346 2 figs. Describes an adjustable snap gage and setting micrometer, which is said to be adaptable and inexpensive.

GAS PRODUCERS

FUEL ECONOMY. Fuel Saving in Modern Gas Producers and Industrial Furnaces, W. B. Chapman. Mech, Eng., vol. 43, no. 11, Nov. 1921, pp. 717-721, 7 figs. Calls attention to fuel wastes in industries using gas producers and producer-gas furnaces, reviews progress in last 25 years in gas-producer construction, and describes distinctive type of recuperative furnace and extension of its use to pulverized coal and oil. (Abstract.)

GAS WORKS

LOW GRADE FUELS, USE OF. Gas-Works Steam-Raising and the Use of Low-Grade Fuels, H. L. Bateman. Gas Jl., vol. 153, no. 3010, Jan. 19, 1921, pp. 162-163 and (discussion) 163-164, 1 fig. Discusses Lancashire versus water-tube boilers, forced draught, pulverized fuel, mechanical fuel and ash handling.

GEAR CUTTING

GEAR SHAPERS. Production Shaping. Machy. (N. Y.), vol. 28, no. 3, Nov. 1921, pp. 186-190. 10 figs. Use of shapers in production work in machine-tool building plants.

MACHINE. An Improved Gear Generating Machine. Eng. Production, vol. 3, no. 57, Nov. 3, 1921, pp. 412-415, 7 figs. Details of novel design for helical, straight [illegible] internal gears.

GEARS

EROSION IN HIGH-SPEED. Pitting in High-speed Gearing Machinery (Lond.), vol. 19, no. 472, Oct. 13, 1921, pp. 50-51, 2 figs. Discusses new method developed to eliminate pitting or erosion in teeth of wheels.

HARDENING UNDER PRESSURE. Hardening Gear Under Pressure. Eng. Production, vol. 3, no. 57, Nov. 3, 1921, pp. 426-427, 3 figs. Describes new method.

INVOLUTE. The Evolution of the Involute Gear Tooth—VIII and IX, A.Fisher. Machinery (Lond.), vol, 19, nos 474 and 475, Oct. 27 and Nov. 3, 1921, pp. 101-103, 6 figs and pp. 132-136, 7 figs Involute pitch and pressure angle [illegible]

NON-METALLIC. Design and Manufacture of Non-metallic Gears. Machinery (Lond.) vol. 19, no. 471, Oct. 6, 1921, pp. 6-11, 12 figs. Discusses preparation of rawhide and fabric-base gear materials physical characteristics, design and [illegible]

SPUR. The Production of Spur Gears, R. Waring-Brown. Eng. Production vol. [illegible] and discussion), no 56, Oct 27, [illegible] modern methods Paper presented [illegible]

[illegible] Hobbed Spur Gears, Carl G Olson [illegible] pp 222-224, 5 figs Amount of backlash recommended to provide for unavoidable inaccuracies in machining [illegible]

SYKES GEAR-TOOTH COMPARATOR. The Sykes Gear-Tooth Comparator. Mech. World, vol. 70, no. 1814, Oct. 7, 1921, pp. 280-282, 4 figs. May be used for comparing and definitely measuring thickness of teeth, for comparing uniformity of pitch and for ascertaining amount of inaccuracy of tooth shape.

GOVERNORS

SHAFT, ADJUSTING. Adjusting Shaft Governors. Power, vol. 54, no. 17, Oct. 25, 1921, pp. 641-647. Shows how to adjust different types of governors.

H

HANDLING MATERIALS

EQUIPMENT. A Survey of Materials Handling Equipment, R. H. McLain. Chem. Age, (N.Y.), vol. 29, no. 10, Oct. 1921, pp. 427-431, 25 figs. Suggestions for the use of labor-saving devices in chemical manufacture.

HEAT TRANSMISSION

BIBLIOGRAPHY. Bibliography on Heat Transmission. Am. Soc Refrig. Engrs. Jr., vol. 8, no. 2, Sept. 1921, pp. 150-162.

GAS HEATING VS. Comparison of gas and Electric Heating (Comparaison du chauffage au gas et à l'électricité, A. Grebel. Le Génie Civil, vol. 79, no. 12, Sept. 17, 1921, pp. 249-252. Compares 1 kg. of coal transformed with low tension electricity and into gas and by-products. Shows that cost of production is in favor of gas.

HEATING STEAM

ISOLATED POWER PLANT. Heating and its relation to Isolated-Plant Operation. E. L. Wider, Power vol. 54, no. 20, Nov. 15, 1921, pp. 758-761, 8 figs. Discusses factors that make for efficiency and inefficiencies in a combined power and heating plant.

RADIATION, CALCULATION OF. Radiation Calculation Charts. D. N. Crosthwait, Jr., Heat & Vent. Mag. vol. 18, no. 10, Oct. 1921, pp. 27-29, 2 figs. Gives tables of square feet of direct cast iron steam radiation for heat loss through two-pane windows, and through wall area, room temperature 70 degs. Fahr. and outside temperature 0 degs. Fahr. and explains application.

HOBS

GEAR. Inspection of Involute Spur and Helical Gear Hobs. Machinery (Lond.). vol. 19, no. 474, Oct. 27, 1921, pp. 90-95, 19 figs. Testing accuracy of hob and tooth parts; hobbing test.

HOISTING MACHINES

SAFEGUARDS. Hoisting and Conveying. Power Plant Eng., vol. 25, no. 20, Oct. 15, 1921, pp. 1000-1003. Machinery safeguards and safe operation.

HOTWATER SUPPLY

WATER-TEMPERATURE CONTROL. Determination of Hot Water Requirements. William Wilcox. Heat & Vent. Mag., vol. 18, no. 10, Oct. 1921, pp. 31-35, 7 figs. Essential points to be considered, with data on apartment houses and various methods of water-temperature control.

HOUSE

WALL CONSTRUCTION. Design and Construction of Dwelling House Walls, Carroll Beale. Concrete Products, vol. 21, no. 4, Oct. 1921, pp. 51-52. Discusses types of construction including concrete. Reprinted from Contractors Atlas.

HOUSING

GARDEN CITY SCHEME, LONDON. Building Garden-Cities at the London Conference (La Construction des Villes et Cités-Jardins à la conférence de Londres), M. De Heem. Annales des Travaux Publics de Belgique, col. 22, no. 4, August 1921, pp. 595-626, 11 figs. Partly on supp. plates. Discusses the housing question and recent competition in designs in London. Gives illustrations.

SHERBROOKE, CAN. Housing Developments in Sherbrooke. Contract Rec., vol. 35, no. 45, Nov. 9, 1921, pp. 968-969, 8 figs. Model city built to house workers of Cana dian Connecticut Cotton Mills.

HYDRAULIC TURBINES

DRAFT TUBES. Draft Tubes—How They Operate and Why. Power, vol. 54, no 16, Oct 18, 1921, pp 600-604, 17 figs Elementary, non-mathematical explanation of hydraulic draft tubes. Use of barometers and scenic railway to illustrate fundamental principles involved.

SPEED REGULATION. Speed Regulation of Hydraulic Turbines John S. Carpenter Power Plant Eng., vol. 25. nos. 19 and 20. Oct. 1 and 15, 1921, pp. 947-950 and 990-993, 5 figs. Principles and methods of calculation involved in design of hydraulic turbin governors

Speed Regulation in the Hydraulic Plant, N. L. Devendorf. Power vol, 54, no. 20, Nov. 15 1921, pp. 764-767, 6 figs. Conditions that must be met by waterwheel governor. Development from early flyball governor to present oil-pressure type. Requirements of low-head versus high-head plants. Operating in parallel.

HYDROELETRIC DEVELOPMENT

Belgium. Utilizing Hydraulic [illegible] (L'utilisation des énergies hydrauliques [illegible] Revue Universelle des Mines, vol. 11, no. 1, Oct. 1, 1921, [illegible] works, reservoirs, dams, canals, power plants [illegible] equipment, etc.

Colorado River. Electrical Construction Plan for Colorado River, Charles Heston Peirson. Elec. Rev. (Chicago), vol. 70, no. 16, Oct. 15, 1921, pp. 586-588. Comprehensive development proposed to regulate streem flow for utilization of available water power.

Switzerland. Plans for Hydroelectric Development in the Bernese Oberland (Les projets des Forces Mortices Bernoises dans l'Oberhasle), Jean Ganguillet. River and Schweiz. [illegible] vol. 12, no. 8, Aug. energy 1921, pp. 209-216, 2 figs. Presents plans for harnessing the Aar for developing in Oberhasle the future greatest source of electric energy in Switzerland.

HYDROELECTRIC PLANTS

Maximum Rates. Determination of Maximum Rates for Hydroelectric Power Centrals (La fixation des tarifs maxima dans les cahiers des charges des concessions d'énergie hydraulique), G. Tochon. Revue Générale des Electricité, vol. 10, no. 13, Oct. 1, 1921, pp. 451-455. Discussion of standard specification for maximum rates proposed by Ministry of Public Works.

I

ICE PLANTS

Brine Agitation. Modern Propeller Design for Brine Agitation and Circulation, E. A. Burrows, Am. Soc. Refrig. Engrs. Jl., vol. 8, no. 2, Sept. 1921, pp. 127-133 and (discussion) 133-134. 10 figs. Describes experiments with Halvorsen propeller, reducing power consumption from 25 to 50 per cent.

INDEXES

Construction and Comparison. Details of Index Number Construction and Comparison of Indices. E. E. George. Eng. & Contracting, vol. 56, no. 19 Nov. 9, 1921, pp. 431-434, 3 figs. Notes on volume of production index. Bradstreet's, Dun's, and Federal Reserve index, standard and tests, and cost of-living indexes.

INDUSTRIAL MANAGEMENT

Distribution of Manufacturing Expense. The Distribution of Manufacturing Expense, C. Haigh. Can. Machy., vol. 26, no. 15, Oct. 13, 1921, pp. 34-36. Discusses five methods for distributing overhead expense: man-rate; man-hour; material and labor; sold-hour; and machine-hour rate.

Factory Investigation. How Faactory Investigations Reduce Costs, Albert A. Dowd and Frank W. Curtis. Machy. (N. Y.), vol. 28, no. 3, Nov. 1921, pp. 208-212, 7 figs. Discusses effect of design upon cost of machining and gives examples of savings realized by change of design; savings effected in drilling and by use of punch press.

Material Control. Material Control for the Small Industrial Plant, Henry C. Haskell. Indus. Management, vol. 62, no. 5, Nov. 1921, pp. 271-273, 1 ig. Describes simple, direct and logical method of approaching problem. Includes illustration of stock card used in system which includes material costing, ordering and planning.

Purchasing Department. Purchasing, A. B. Johnson. Paper, vol. 28, no. 19, July 13, 1921, pp. 17-19, 28 and 38. Discusses work and organization of purchasing departments. Paper read before Superintendents' Assn.

Scientific. Scientific Management—XXXII. Henry Atkinson. Eng. & Indus. Management, vol. 6, no. 15, Oct. 13, 1921, pp. 400-401 and 403. Failures of scientific management and their cause.

Stores Records. Machine-Posted Balance of Stores Records, C. Moffitt Ford. Bul. Taylor Soc., vol. 6, no. 4. August 1921, pp. 139-152, 4 figs. Discusses mechanical equipment and card design; posting of cards; method of proof; filing, posting and verifying routine: etc. Paper read before Phila. Section of Taylor Soc.

INDUSTRIAL ORGANIZATION

Reorganizing Small Works. Reorganizing the Small Works, H. [illegible] Eng. & Indus. Management, vol. 6, no. 17, Oct. 27, 1921, pp. 459-462. 9 figs Writer demonstrates importance of forming clear idea of conditions of working capabilities of staff, and proper locations and layout of plant, in describing practical system of reorganization. Notes on planning organization chart.

Stimulating Interest of Workers. Making Work Fascinating as the First Step Toward Reduction of Waste, Water N. Polakoy. Mech. Eng., vol. 43. no. 11, Nov. 1921, pp. 731-734 and 765, 7 figs. Points out that such experiments as have been already conducted in uniting brain work with manual work have proved beyond any doubt that such a course liberates dormant or suppressed creative capacities of men, improves quality and quantity of production, and, above all, substantially ameliorates industrial relations. Advantages to owner and labor groups are set forth. Abstract.

INDUSTRIAL RELATIONS

Co-opèration. Experiments in Industrial Co-operation. Iron Age, vol. 108, no. 19, Nov. 10, 1921, pp. 1207-1208. Constructive solutions of employer-employee relations presented at meeting of Acad. of Political Science.

Economic Axioms. The Economic Axioms of Industry, E. W. Petter. Eng. & Indus. Management vol. 6, no. 18, Nov. 3, 1921, pp. 50?-502. Notes on creation and unequal distribution of wealth; community's well-being; employer and worker; piece-work rates; unemployment doles and waste; how the State can assist. (Abstract.) Lecture arranged by Indus. League & Council.

Human Factor. The Human Factor in Industry— II, Clarance H. Northcott. Indus. Management, vol. 62, no. 5, 1921, pp. 292-297, 4 figs. Points out importance of weighing physical and mental differences and study of job in vocational selection. Discusses motion study, fatigue, rest periods, etc.

Industrial Court, Great Britain. The Industrial Court of Great Britain and Ireland, R. W. Patmore, Indus. Management, vol. 62, no. 5, Nov. 1921, pp. 269-271. Its history, functions and personnel.

INTERNAL COMBUSTION ENGINES

Carburation. Study of Carburation, Thermodynamics of the Explosion Engine (Introduction à l'étude de la carburation, pyrodynamique du moteur à explosion), M. Carbonaro. Memoires et Compte Rendu des Travaux de la Société des Ingénieurs Civiles de France, vol. 74, nos. 4-5-6, April-June 1921. pp. 185-249, 13 figs. Discusses deflagration at constant pressure. ignitions temperature, flame propagation and its velocity, etc.

Cooling-Water Systems. Cooling Water Systems for Internal Combustion Engines, Edgar J. Kates. Power, vol. 54, no. 20, Nov. 15, 1921, pp. 710-713, 4 figs. Notes on quality of water; use of cooling tanks; open cooling systems and their faults; inclosed cooling systems.

Increasing Power Output. Petrol Engine Performance. Times Eng. Supp., no. 564, Oct. 1921, p. 277. Notes on increasing power output.

Supercharging. Supercharging Engine, C. H. T. Alston.. Automobile Engr., vol. 11, no. 155, Oct. 1921, pp. 337–341, 2 figs. Discusses advantages and disadvantages; its application to aircraft, road motor vehicles, marine, stationary, and portable engines; etc.

See also [illegible]

IRON

Gray, Oxygen in. Discusses Problems of the Foundry, J. Shaw. Foundry, vol. 49, no. 19, Oct. 1, 1921, pp. 759-761. Discusses different view of metallurgists regarding effect of oxygen in gray iron. Methods of making physical tests and their effects on results are pointed out.

Pig and Cast Composition of. Composition of Pig Iron and of Cast Iron, Y. A. Dyer. Iron Age. vol. 108, no. 20, Nov. 17, 1921, pp. 1267-1270. Chemical and structural composition. Various elements, their characteristics and effect on metal. Oxygen in iron.

IRON, PIG

Mixer. Pig Iron Mixer. Eng. Progress, vol. 2, no. 10, Oct. 1921, pp. 227-230, 8 figs. Advantages of mixing process; rolling and tilting mixer; electrical tilting device.

Synthetic. Synhtetic Foundry Pig Irons in Germany. Iron Age, vol. 108, no. 18, Nov. 3, 1921, pp. 1137-1138. Methods of production during war to overcome scarcity of low phosphorus irons; their properties; charcoal iron. Translated from Stahl u. Eisen, June 30, 1921.

K

Carburation. Carburation of Kerosene and the Action of the Wall (La carburation par le pétrole lampant et l'action de paroi), G. Lumet. Memoires et Compte Rendu des Travaux de la Société des Ingénieurs Civils de France, vol. 74, nos. 3–5–6–, April-June, 1921, pp. 291-300. Discusses effect of cooling the walls and gives results of tests made, also tables.

L

LABOR

Hours of Work. The Eight Hour Law (La Loi de Huit Heures), Leon Repaels. Revue Universelle des Mines, vol. 10, no. 6, Sept. 15 1921, pp. 651-676. Discusses its provisions and its application and why Belgium cannot ratify the Washington eight-hour convention.

Organization. The Purpose of the Labor Articles in Automotive Industries, Harry Tipper. Automotive Industries, vol. 45, no. 15, Oct. 13, 1921, pp. 732-733. Points out necessity for studying human side of production activities with a view to preventing trouble rather than waiting for difficulties to arise and then attempting to find a remedy. Production cost depends largely upon human organization.

LABOR TURNOVER

PROBLEM. A Common Sense Attack on Turnover, James R. Adams. Indus. Management, vol. 62, no. 5, Nov. 1921, pp. 298-302, 4 figs. Writer tells what has been done under Studebaker Corp. under present conditions, to make employees appreciate management's problems and to enlist their intelligent co-operation for the common good.

LABORATORIES

APPLIED MECHANICS. A Laboratory of Applied Mechanics (Notice sur le Laboratoire de Mécanique appliquée), J. Boulvin, F. Keelhoff, G. Van Engelen, O. Steels. Annales de l'Association des Ingénieurs Sortis des Écoles Spéciales de Gand, vol. 11, 5th, Series, 1921, pp. 130-148. Discusses its functions, and equipment for teaching purposes.

GAS. The Industrial Laboratory of the Bourbonnais Co. (Le Laboratoire industriel de la Compagnie du Bourbonnais) J. H. Brodin. Chaleur et Industrie, vol. 2, no. 17, Sept. 1921, pp. 554-560, 4 figs. Discusses development and equipment dedicated to gas interests.

SCIENTIFIC INDUSTRIAL RESEARCH. A Modern Scientific Industrial Research Laboratory and Its First Results (Un exemple de laboratoire moderne pour recherches de science industrielle ses premiers résultats). Georges Baume. Revue Générale de l'Électricité, vol. 10, no. 12, Sept, 24, 1921, pp. 396-398. Discusses laboratory of Société de Recherches et Perfectionnements Industriels, founded in 1919 at Puteaux, and how it works.

LATHE TOOLS

CIRCULAR FORM TOOLS. Designing Circular Form Tools. Eng. Production, vol. 3, no. 55, Oct. 20, 1921, pp. 370 371, 2 figs. Describes use of pratical formulas.

APRON DESIGN. Lathe Aprons. A. Clegg. Eng. Production, vol. 3, no. 55, Oct. 20, 1921, pp. 373-378, 12 figs. Comparison between typical English and American designs.

FEED REVERSE MECHANISMS. The Design of Feed Reverse Mechanisms for Lathes, A. Clegg. Machinery (Lond.), vol. 19, no. 472, Oct. 13, 1921, pp. 34-39, 13 figs. Discusses the tumbler, fixed center, bevel, and planetary or epicyclic gears, and their advantages and disadvantages.

HEADSTOCK DESIGN. Improved Lathe Headstock Details and their Jigs, Hubert Hentley. Eng. & Indus. Management, vol. 6, no. 15, Oct. 13, 1921, pp. 398-399, 4 figs. Describes very simple and successful type of spring-locking bolt and jig employed to ensure accuracy in drilling of locking bolt holes in both cone and gear wheel.

"NON-STOP" METHODS. Devices for Repetition Work. Eng. Production, vol. 3, no. 56, Oct. 27, 1921, pp. 392-393, 4 figs. Describes certain non-stop methods, by means of which lathes or machines are kept running.

TURRET. Production Work in the Locomotive Shop Machy.(N. Y.), vol. 28, no 3, Nov. 1921, pp. 228-230, 2 figs. Application of the Bullard vertical turret lathe.

LIGHTING

EXTERIOR AND INTERIOR. Improved Practices in Exterior and Interior Illumination. Elec. World, vol. 78, no. 20, Nov. 12, 1921, pp. 971-974, 8 figs. Broadening applications of modern equipment yielding greater service to industry and homes.

FACTORY. Better Illumination Cuts Production Costs, Ward Harrison, Orville F. Haas and Fred W. Dopke. Elec. World, vol. 78, no. 16, Oct. 15, 1921, pp. 763-764, 2 figs. Test data show increase in production of 12.2 per cent due to installation of modern lighting system. Tests made by Dover Mfg. Co., Dover, Ohio.

STREET. Recent Developments in Street Illumination, C. W. Koiner. Eng. & Contracting, vol. 56, no. 18, Nov. 2, 1921, p. 420. Discusses gas-filled lamps; type and height of post; cost of installation and wiring of ornamental system: cost of street lighting etc. Report of committee on street lighting presented before Am. Soc. Mun. Improvements.

LIME

[illegible] The [illegible] Art of Lime Burning, George B. Wood. Chem. & Met. Eng., vol. 25, no. 15, Oct. 12, 1921, pp. 705-708, 6 figs. Complete mechanical handling [illegible] and precise technical control of all operations have been pro[illegible] plant of Rockland & Rockport Lime Corp. Crushing plant, kilns, charging equipment, storage and packing. Paper read before Nat. Lime [illegible]

LOCOMOTIVE BOILERS

[illegible] and Fixing Fire Tubes in Locomotive Boilers [illegible] tubes à fumée dans les chaudières de locomotives, [illegible] Technique, vol. 13, no. 2, Feb. 1921, pp. 59-62, 12 [illegible] apparatus for the purpose.

LOCOMOTIVES

[illegible] Operating Factors. Ry. Rev., vol. 69, [illegible] Results of test made with five new [illegible] fitted with boosters. Operating [illegible]

ECONOMIC USE OF STEAM. On the question of the Economic Production and Use of Steam on Locomotives, Maurice Lacoin. Bulletin International Ry. Assn., vol. 3, no. 9, Sept. 1921, pp. 1157-1204, 35 figs. Discusses steam superheating and compounding, packings, valves, feedwater heating water-tube boilers, scale, combustion control, etc. Appendixes.

ECONOMICAL DESIGN. Avoidable Waste in Locomotive Operation as Affected by Design James Partington, Mech. Eng., vol. 43, no. 11, Nov. 1921, pp. 729-730. Points out that best way to overcome waste is to design locomotive so that it will fulfill efficiency requirements of (1) a drawbar horsepower for minimum amount of fuel, (2) for minimum amount of weight of locomotive and tender, and (3) for minimum cost of repairs, and shows how these are secured. (Abstract)

FEEDWATER HEATING. Feed Water Heating on the London & North Western Railway. Ry. Gaz., vol. 35, no. 16, Oct. 14, 1921, pp. 572-574, 2 figs. Details of latest application of Weir feed water heating system and pump to "George the Fifth" class of express locomotive.

FLOATING BUSHINGS. The Development of Floating Bushings. Ry. Rev., vol. 69, no. 17, Oct. 22, 1921 pp. 535-538, 5 figs. Describes early development and recent application to new locomotives built by Am. Locomotive Co.

MALLET. Virginian Mallet Locomotives. Ry. Jl., vol. 27, no. 10, Oct. 1921, pp. 12-13 1 fig. Tractive power 147, 200 lb., working compound and 176,600 lb., working simple; 2-10-10-2 type. Comparison with 2-8-8-2 type.

MEXICAN RAILWAYS. New Power for Rehabilitation of Mexican Railways. Ry. Rev., vol. 69, no. 18, Oct. 29, 1921, pp. 578-580, 5 figs. Baldwin builds nearly 100 locomotives comprising five distinct type for service on heavy grades. See also Ry. Age, vol. 71, no. 26, Nov. 12, 1921, pp. 937-939.

OPERATION. Traveling Engineers Present Valuable Reports. Ry. & Locomotive Eng., vol. 34, no. 10, Oct. 1921, pp. 265-271. Discusses operation and maintenance of oil-burning locomotives, self-adjusting wedges, feedwater heaters, devices for increasing tractive power, and operating stoker-fired locomotives. Report of Executive Committee.

SULPHATE OF AMMONIA MANUFACTURE. The Manufacture of Neutral Sulphate of Ammonia at the Bedford Gas-Works, J. B. Hansford. Gas Jl., vol. 155, no. 3046, Sept. 28, 1921, pp. 721-722 and (discussion) 722-723, 1 fig. Describes plant and operations. Paper read before Eastern Counties Gas Managers' Assn.

PAULISTA RAILWAY, BRAZIL. Electric Motive Power for Paulista Railway. Ry. Age, vol. 71, no. 16, Oct. 15, 1921, pp. 721-722, 3 figs. Describes electric freight and passenger locomotives for Brazil; tractive efforts at 25 per cent adhesion 58,500 lb. and 51,000 lb. respectively.

THERMIC SIPHONS. The Installation and Operation of Thermic Syphons. Boiler Maker, vol. 21, no. 10, Oct. 1921, pp. 273-277, 12 figs. Discusses application to locomotives as an efficiency-promoting device.

LUBRICATION

TESTS on STEAM AND GASOLINE ENGINES. Comparative Lubrication Engineering. Sci. Lubrication, vol. 1, no. 9, Sept. 1921, pp. 18-21. Describes test on small-power Corliss engine, and on a Continental motor, giving some interesting dilution data.

LUBRICATING OILS

CASTOR AND MINERAL-OIL MIXTURE. Tests of Castor Oil and Mineral Oil Mixtures on Gnome Rotary Engine, O. J. May and Howard Cooper. Sci. Lubrication, vol. 1, no. 9, Sept., 1921, pp. 10-14, 6 figs. U. S. Army Service report discussing method and results of tests made.

M

MACHINE CONSTRUCTION

RECORD OF MATERIALS. Record of Materials Used in Machine Construction. Machinery (Lond.), vol. 19, no. 471, Oct. 6, 1921, pp. 1-3, 4 figs. Gives details of a "commodity book" in which are recorded all materials and standard parts used by the firm; these records are kept up-to-date. Various advantages are claimed for this book.

MACHINE SHOPS

ENGLISH. Famous British Works. Eng. Production, vol. 3, nos. 55, 56 and 57. Oct. 20, 27 and Nov. 3, 1921, pp. 362-363, 4 figs., 386-388, 4 figs., and 410-411, 2 figs. Oct. 20: Worcester works of Heenan & Froude, Ltd., for manufacture of Froude dynamometers, Heenan air filters, oil and water coolers, refuse destructors, and refrigerating machinery, Oct. 27: Works of Marshall, Sons & Co., Ltd., Gainsborough, Lincolnshire, for manufacture of engines, boilers and machines, Nov. 3: Works of John Fowler & Co., Ltd., Leeds, for manufacture of steam plows, road-transport and heavy-haulage engines, traction engines, etc.

The Wellman Smith Owen Engineering Works at Darlaston. Iron & Coal Trades Rev., vol. 103, no. 2798, Oct. 14, 1921, pp. 545-546, 18 figs. on pp. 547-550. Describes machine, fitting and erecting, and pattern shops, laboratory, welfare section, etc.

LAYOUT. Building Machine Tools in a New Plant, F. L. Prentiss. Iron Age, vol 108, no. 17, Oct. 27, 1921, pp. 1070-1075, 16 figs. Arrangement, transportation system, routing of material and lighting are features of Colburn Machine Tool Co., Cleveland, Ohio.

Factory Lay-out as an Aid in Reducing Costs. Machy. (N.Y.), vol 28, no 3, Nov. 1921, pp. 182-185, 8 figs. Describes new plant of Colburn Machine Tool Co., Cleveland, Ohio, laid out with view to economy in Manufacturing.

MACHINE-TOOL INDUSTRY

Orient as Market. The Orient as a Machine-Tool Market, W. E. Rastall. Am. Mach., vol. 55, no. 18, Nov. 3, 1921, pp. 730-735. Data on pre-war growth of foreign business and growth since 1915; foreign markets other than European. How to sell machinery in Asia. Address before Machine Tool Builders.

MACHINERY

Dismantling. Valuable Hints on the Dismantling of Machinery. Can. Machy., vol. 26, no. 15, Oct. 13, 1921, pp. 29-32, 8 figs. Discusses separation of rusted parts, seized parts, forcing methods, and bolt action.

Perforated-Record Control. The Control of Machines by Perforated Records, Emanuel Scheyer. Am. Mach., vol. 55, no. 19, Nov. 10, 1921, pp. 743-747, 8 figs. Principles of pneumatic and electric control of machinery. Difficulties of automatic control. Machines controlled by paper records.

MANGANESE STEEL

Castings, Grinding. Grinding Manganese Steel Castings, F. B. Jacobs. Foundry, vol. 49, no. 19, Oct. 1, 1921, pp. 767-770, 8 figs. Frogs and switches produced from accurate patterns and carefully molded. Ground because too hard to machine Annealed before grinding. Wheels are coarse grit in hard grades.

MAPPING

Aerial Photography in. Aerial Photographic Mapping Developed for Municipal and other Engineering Services, Frederick E. Jones. Eng. News-Rec., vol. 69, no. 15, Oct. 13, 1921, pp. 596-599, 5 figs. Wide variety of uses includes traffic studies, street layout and waterfront development. Methods and equipment improved since war. Exposures made automatically.

MATERIALS

Testing. Testing Materials, T. W. MacAlpine, Eng. & Indus. Management, vol. 6, no. 18, Nov. 3, 1921; pp. 498-499. Plea is advanced for formation of a British National testing organization

MEASURING MACHINES

Internal Diameters. A Machine for the Measurement of Internal Diameters. G. A. Tomlinson. Engineering, vol. 112, no. 2912, Oct. 21, 1921, pp. 558-560, 6 figs. Describes method and machine developed at Nat. Physical Laboratory, Teddington, England, which is said to give high accuracy and allow inside diameter to be explored to any extent necessary.

METALLOGRAPHY

Microscopic Examinations. Metallography—The Microscopic Study of the Structure of Metals, Henry S. Rawdon. Am. Mach., vol. 55, no. 17, Oct. 27, 1921, pp. 659-664, 29 figs. Value of metallurgical science in industry; uses of the microscope. Study of metallic structures. Results of microscopic examinations.

Optics of. The Optics of Metallography, W. I. Patterson. Trans. Am. Soc. for Steel Treating, vol. 2, no. 2, Nov. 1921, pp. 108-132, 36 figs. Deals with important optical parts of microscopes.

METALS

Cold Work, Effect of. Strengthening Metals by Cold-Work, E. Heyn. Chem. & Met. Eng., vol. 25, no. 16, Oct. 19, 1921, pp. 735-736, 2 figs. Explains nature of changes in cold worked metal elastic and plastic deformation, etc. From Metall und Erz, 1918, Nos. 22 and 23.

Rolling. Metal Rolling (Le Laminage), Sigma, La Métallurgie, vol. 53, no. 40, Oct. 6, 1921, pp. 1884-1887. Discusses longitudinal or parrallel rolling; cross or circular rolling, i.e., reeling; and helicoidal or oblique rolling, as for Mannesmann tubes.

Structural Properties. Structural properties of Metals and Alloys, R. W. Woodward. Am. Mach.; vol. 55, nos. 15 and 16, Oct. 13, and 20, 1921, pp. 596-599 and 636-638, 2 figs. Applicability of metals; factors of strength and elasticity; compression; ductile and brittle materials; fatigue; thermal, Magnetic and optical properties; corrosion.

METRIC SYSTEM

Arguments Pro and Con. The Metric System of Weights and Measures, David A. Molitor, Jl. Eng. Inst. Can., vol. 4, no. 11, Nov. 1921, pp. 569-572. Advantages of system, legal problems, transition steps.

Metric versus English System. Eng. & Contracting, vol. 56, no. 18, Nov. 2, 1921, pp. 426-427, Summarizes points in favor and opposed to metric bill. Reprinted from Lefax.

MILLING CUTTERS

Formed. Formed Milling Cutters, George H. Strain, Machinery (Lond.), vol. 19, no. 474, Oct. 27, 1921, pp. 109-112, 18 figs. Factors in design which eliminate waste of driving power; cutting angles, rake and clearance of circular tools; standards for convex and concave formed milling cutting.

MILLING MACHINES

Rotary. Reducing Costs by Rotary Milling. Machy., (N.Y.), vol. 28, no. 3, Nov. 1921, pp. 202-205, 10 figs. Examples of work advantageously handled on Becker vertical rotary milling machines.

MONEL METAL

Welding. Monel Metal Welding, Michael Dzamba, Welding Engr., vol. 6, no. 10, Oct. 1921, pp. 41-42. Discusses welding generally, also welding of rods, sheets and castings, and soldering.

MOTOR BUSES

British Isles. Motor Bus and Motor Coach Transportation in the British Isles, Walter Jackson, Automotive Industries, vol. 45, no. 17, Oct. 27, 1921, pp. 827-831, 3 figs. Automotive vehicles are successfully competing with British railroads and tramways in both short and long haul passenger traffic.

MOTORSHIPS

Diesel-Engined. New Italian Motorships "Ardito" and "Primula". Motorship, vol. 6, no. 10, Oct. 1921, pp. 805-809, 4 figs. Describes Tosi Diesel engine equipments which gave excellent performance. Ardito is propelled by two four-cycle, single acting Tosi engines; Primula by two six-cylinder four-cycle engines. Deadweight 8000 and 3600 tons respectively; speeds 12 knots. See also Shipbldg., & Ship'g Rec. vol., 18, no. 13, Sept. 29, 1921, pp. 412-414.

MOTOR TRUCKS

Future. The Motor Truck of the Future, Rolin W. Hutchinson. Indus. Management, vol. 62., no. 5, Nov. 1921, pp. 257-261, 4 figs. What permanent highways, pneumatic tires and ferro-steel will do in revolutionizing motor-truck engineering.

N

NICKEL ALLOYS

Nickel-Aluminum-Copper. The Properties of Some Nickel-Aluminum-Copper Alloys, A. A. Read and R. H. Greaves. Metal industry (Lond),vol. 19, no. 13, Sept 23, 1921, pp 232-239, 23 figs. Discusses preparation; rolling and machining; tensile tests; properties of cast, cold-rolled and heat-treated alloys, etc. Paper read before Inst. of Metals.

NICKEL METALLURGY

Rolling. Rolling Pure Nickel, A. E. Surface. Sci. Am., vol. 125-A, no. 17, Nov. 1921, p. 34, 3 figs. Describes rolling of 99 per-cent pure nickel into the various shapes into which mild steel is rolled, according to method developed by Charles T. Hennig and carried out at plant at Hyde, Pa.

NUTS

Acme Thread. Making an accurate Acme Thread Nut, B. M. W. Hanson. Machy (N. Y.) vol. 28, no. 3, Nov. 1921, pp. 197-199, 4 figs. Notes on difficulty of obtaining proper contact between screw and nut; use of roughing and finishing taps; lubrication when tapping; holding an Acme tap in a turret lathe.

O

OIL ENGINES

Still. The Still Engine. Mar. Engr. & Naval Architect, vol. 44, no. 528, Sept. 1921, pp. 36-40, 4 figs. Describes engine which may be two-stroke or four-stroke type; burns gas, petrol or oil. Advantages, starting, overload, efficiency, etc.

OIL FUEL

Burning. The burning of Oil Fuel, Å. Keens. Mar. Engr. & Naval Architect, vol. 44, 529, October 1921, pp. 76-85, 12 figs. Discusses various types of machinery and its arrangement for burning oil fuel. Observations and comments derived from experience.

Handling. Security in Handling Inflammable Liquids Chem. Age (Lond.), vol. 5, no. 119, Sept. 24, 1921, pp. 372-373, 1 fig. Describes Mauciére patent for storage and protection of petrol which also permits distribution either in a continuous flow or in predetermined quantities.

Power Uses. The Application of Oil to Power Purposes, Sydney H. North. Trans. Inst. Mar. Engrs., vol. 33, Sept. 1921, pp. 325-331. Shows increase in water evaporated per lb. of oil, and in thermal efficiency of Diesel engines.

OIL STORAGE

Shipyard Plant. Shipyard Bulk Storage Oil and Paint Plant. Engineering, vol. 112, no. 2914, Nov. 4, 1921, p. 632, 10 figs. partly on p. 634. Describes installation at new yard of Furness Shipbuilding Co., designed with steel storage tanks and automatic measuring pumps for distribution of oils, layout being such as to reduce cost and increase ease of handling.

OILS

[illegible] Air [illegible] Baking [illegible] with Linseed Oil, A. A. Grubb and U. S. Jamison. Chem. & Met. Eng., vol. 25, no. 17, Oct. 26, 1921, pp. 793-795. [illegible] and plant experiments on consumption of air and oxygen [illegible] linseed oil [illegible] cores, together with a review of available [illegible] oxygen [illegible] by linseed oil in drying.

P

PARACHUTES

Aeronautical Life Belts. Parachutes. T. Orde Lees. Aviation ,vol. 11, nos. 16 and 17, Oct. 17 and 24, 1921, pp. 451-453 and 485-488, 5 figs. Discusses parachutes in the sense of aeronautical life-belts, for pilots and passengers. Lecture before Roy. Aeronautical Soc.

PAVEMENTS

[illegible] Strength of [illegible] Highway Department Makes Road Tests, Clifford Older and H. F. Clemmer. Automotive Industries, vol. 45, no. 15, Oct. 13, 1921, pp. 716-719, 6 figs. New devices used in research work to determine comparative strength of various types of road pavement. Uniformity of subgrade under each of sections of road discovered by observations for moisture content and bearing power of soil under static and impact loads.

PAVEMENTS, BITUMINOUS

[illegible] Bituminous Pavement Design.—Aggregate Survey, F. S. Besson Mun. & County Eng., vol. 61, no. 4, Oct. 1921, pp. 123-133, 8 figs. Results of investigations made in Dist. of Columbia show clearly that defects of bituminous pavements can not be charged entirely to deficient compaction, not to presence of smooth grains in aggregate, not to existence of rigid bases. Includes diagram showing bitumen requirements for pavements as controlled [illegible] and [illegible] gravity of mineral aggregate.

PAVEMENTS, WOOD-BLOCK

[illegible] The Minneapolis Experimental Wood Block Pavement After 15 Year's Service. Eng. & Contracting, vol. 56, no. 18, Nov. 2, 1921, pp. 415-417, 2 figs. Experimental pavement laid for purpose of studying relative merits of different species of wood for paving block material; effect of length of blocks on wearing qualities of pavement; influence of heartwood and sapwood on durability; and relative wear on blocks laid at different angles. Gives results [illegible] obtained.

PIPE, CAST-IRON

Manufacture. Cast-Iron Pipe. The Method of Manufacture and its Inspection, William R. Conrad. N. E. Water Works Assn., vol. 35, no. 3, Sept. 1921, pp. 205-220 and discussion) pp. 220-227, 6 figs. Discusses manufacturing [illegible] drying, pouring, cleaning and testing.

Standardized. Standardized Cast Iron Pipes. Eng. Production, vol. 3, no. 56, Oct. 27, 1921, pp. [illegible], 10 figs. Describes methods of Stanton Ironworks Co., Ltd., Nottingham, England, as example of advantages attendant on standardization [illegible] product.

PIPE, CONCRETE

Alkali Soils, in. Concrete Pipe in Alkali Soils. Pub. Works, vol. 51, no. 16, Oct. 15, 1921, pp. 292-294. Investigations made in Minnesota indicate that [illegible] liable to decomposition when water in surrounding soil contains [illegible] parts per million of alkali salts. Abstract Papers by Dalton [illegible] and [illegible] published in Bul. Minn. Federation of Architect[illegible]

PIPE, STEEL

Butt-Welded. Recent Improvements in the Manufacture of Welded Pipe, F. N. Speller, Blast Furnace & Steel Plant, vol. 9, no. 10, Oct. 1921, pp 580- 582. While there have been many improvements in appliances for butt-welding pipe since introduction of this process, the method of finishing has not been [illegible]

[illegible] A Hammer Welded Steel Pipe. Iron Age, vol. 108, no. 18, Nov. 3, 1921, pp. 1130-1131, 3 figs; also Iron Trade Rev., vol. 69, no. 18, Nov. 3, 1921, pp. 1148-1151, 7 figs. Product of Natural Tube Co., Pittsburgh. Steel plates are bent to require shape and overlapping edges are heated and welded under hammer. Hammer-weld process adapted to large sizes of pipe. Pro[illegible]

[illegible] Its Manufacture and Use. Eng. & Contracting [illegible] Notes on sizes and thickness, manufacturing process; physical properties of material; joints; elements of economy [illegible]

PISTONS

Aluminum, Machining. Precising Machine Work in the Production of Aluminum Pistons, J. Edward Schipper, Automotive Industries, vol. 45, no. 15, Oct. 13, 1921, pp. 722-725, 15 figs. Methods employed in manufacturing pistons for Essex engine. Special care exercised in machining piston pin-hole square with piston axis, and in aligning piston with cylinder bore.

Machining. Machining Hudson Super-Six Pistons. Machy. (N.Y.), vol. 28, no. 3, Nov. 1921, pp. 225, 227, 5 figs. Methods used by Hudson Motor Car Co. in producing pistons with high-production machinery at low cost.

PLATES

Stresses in Rectangular. Two Dimensional Stresses in Rectangular Plates, C.E. Inglis. Engineering, vol 112, no. 2910, Oct. 7, 1921, pp. 523-524, 3 figs. Outlines general analytical method for investigating two-dimensional distributions of stress set up in rectangular plate by stresses applied along its edges in any arbitrary manner.

POWER

Industrial, Analysis of. Analysis of Industrial Power, H. Goodwin. Power vol. 54, no.16, Oct. 18, 1921, pp. 584-588, 3 figs. Investigations based on latest census returns from North Atlantic States show more than 76,000 industrial plants, using in aggregate over 9,000,000 hp. of which over 2,000,000 hp. is supplied by steam engines, 600,000 by steam turbines, 540,000 by water power, 279,000 by internal-combustion engines, and remainder purchased power.

POWER GENERATION

Cost Systems. How to follow Up Power Costs, N. A. Graigue. Indus. Management, vol. 62. no. 5, Nov. 1921, pp. 275-279, 3 figs. Analysis and distribution of operating costs to consumers.

Fuel Economy. Fuel Economy by the Adoption of Scientific Management in Power Generation and Utilisation. David Brownie, Eng. & Indus. Management, vol. 6, nos.14, 15 and 16, Oct. 6, 13 and 20, 1921, pp. 393-394 and 396, 421-424, and 433-436, 13 figs. Notes on flue-gas analysis and boiler feedwater meters.

POWER PLANTS

Coal Mine. Mixed Pressure Turbine Installation with Regenerator Appreciably Decreases Power Costs at Nokomis, C. W. Smith. Coal Age, vol. 20, no. 19, Nov. 10, 1921. pp. 753-757, 7 figs. Describes very modern coal-mine power plant at Nokomis mine, Illinois, of Nokomis Coal Co.; capacity 1,300 kw. of which 1,000 kw. is mixed pressure and 300 kw. high-pressure turbine power.

Design. Developments in Power Station Design — XII, XIII and XIV. Engineer, vol. 132, nos. 3432, 3433 and 3435, Oct. 7, 14 and 28, 1921, pp 364-365-, 390-392 and 445-447, 13 figs. Oct. 7, Babcock boilers for utilization of waste heat from coke ovens and blast furnaces. Oct. 14: Halberg-Beth blast-furnace-gas-cleaning plant; Kirke waste-heat boiler with integral economizer; and waste-heat boilers with vertical tubes. Oct. 28: Describes Bonecourt gas-fired boiler unit; Thomson boilers operated with coke-oven gas; Brett drop-forging-furnace waste-heat unit; Babcock & Wilcox furnace for burning saw-mill refuse.

Modern Practice. Refinements of Practice in Modern Power Plants, I. L. Kentish-Rankin. Power Plant Eng., vol. 25, no. 20, Oct. 15, 1921, pp. 988-990. Discusses features regarding furnace construction and the overcoming of difficulties with superheater operation.

Superpower. The Performance and Cost of the Superpower System, Arthur R. Wellwood. Power, vol. 54, no. 19, Nov. 8, 1921, pp. 725-730, 10 figs. As result of work of Superpower Survey, certain vital facts concerning performance and cost of superpower system are presented, and conclusions drawn.

POWER TRANSMISSION

Machine Shops. Transmission of Power in Machine Shops, F. A. Pike. Mech. World, vol. 70, no. 1815, Oct. 14, 1921, p. 298, 3 figs. Advocates more direct driving.

PRESSES

Automobile Parts. Presses and Dies used in the Production of Motor-car Body Parts. Machinery (Lond.), vol. 19, no. 475, Nov. 3, 1921, pp. 117-121, 10 figs. Description of tools and machines used by Austin Motor Co., Ltd., Longbridge Works, Birmingham.

PRICES

Stop-Loss, Finding. Finding the "Stop Loss", Price Point, H. R. Boston, Indus. Management, vol. 62, no. 5, Nov. 1921, pp. 266-268. Definite way of estimating how far a price may be cut.

PULVERIZED COAL

Advantages and Disadvantages. Firing with Pulverized Coal (Le Chauffage au charbon pulvérisé), P. Frion. Mémoires et Compte Rendu des Travaux de la Société des Indénieurs Civils de France, vol. 74, nos.4-5-6-.April-June 1921, pp. 123-172. Report of Commission of Fuel Utilization, appointed by Minister of Pub. Works. Discusses actual developments in use of pulverized coal. Describes installation using it, its advantages and possibilities, and its inconveniences and dangers.

See also Revue [illegible] des Mines, vol. 11, no. 1, Oct. 1, 1921, pp. 48-56.

BOILER FIRING. Burning Powdered Coal and Blast Furnace Gas at River Rouge, Thomas Wilson. Power, vol. 54, no. 18, Nov. 1, 1921, pp. [illegible] figs. Arrangement and construction of [illegible] coal equipment and layout of gas-piping and burners. [illegible] and operating force required.

PUMPING

CENTRIFUGAL AND AIR-LIFT. Modern Pumping [illegible] vol. 132, no. 3170, Sept. 30, 1921, pp. [illegible]. Paper on "Modern High Speed Centrifugal Pumps" by S. F. Barclay and paper on Experiments on Air Lift Pumping by I. S. Owens. Read before British Assn.
See also [illegible].

PUMPS, CENTRIFUGAL

DESIGN AND APPLICATION. The Centrifugal Pump, S. F. Barclay. Engineering, vol. 112, no. 2914, Nov. 4, 1921, pp. 642-644, 8 figs. Notes on Mechanical design and application. (Abstract) Paper read before British Ass.

MANUFACTURE. Manufacturing Centrifugal Pumps. Western Machy., World, vol. 12., no 10, Oct. 1921, pp. 392-395, 12 figs. Describes machine operations on pump bases, brackets, spiral bodies, impellers, etc.

R

RADIOTELEGRAPHY

STATIONS. The Most Powerful Radio Station in the World (La plus puissante station radio-électrique du monde), L.-V. Bournat. La Technique Moderne, vol. 13, no. 2, Feb. 1921, pp. 49-54, 24 figs. Describes French station at Saint-Assise near Melun and German Stations at Nauen and compares their operation.

RAILS

MAGNETIC SURVEYS. Magnetic Surveys of Railroad Rails, Iron Age, vol. 108, no 20, Nov. 17, 1921, pp. 1271-1273 7 figs. Determination of fissures obscured by heavy damage from gagging presses. Improvements being made in section and in straightening.

SECOND-HAND, USE OF. Classificatiom and Distribution of Second Hand Rail for Use in Track. Eng. & Contracting, vol. 56, no. 20, Nov. 16, 1921, pp. 463-464. Notes on supply and demand for used rail; variables to be considered in use of rail, recommended method of assigning and distributing rail.

RAILWAY ELECTRIFICATION

BRAZIL. The Paulista Railway Electrification. S. B. Cooper, Ry. Rev., vol. 69, no. 16, Oct. 15, 1921, pp. 507-509, 8 figs. Describes Westinghouse equipment recently delivered and conditions making electrification desirable.

HEAVY TRACTION. Electrification Report of the A. E.R.A. Ry. Elec. Engr., vol. 12, no. 10, Oct. 1921, pp. 391-396, 1 fig. Report of Committee of the Am. Elec. Ry. Assn. on heavy electric traction. Compares locomotives and multiple unit cars. (Abstract).

ITALY. Electrification Progress on Italian Railways, Giovanni B. Santi. Ry. Elec. Engr., vol. 12, no. 10, Oct. 1921, pp. 371-375, 6 figs.Discusses development of electrification on account of high price of coal and no oil resources. The Valtelline, three-phase, 15-cycle, 3000 volt system has been working for 20 years.

SWISS. The Electrification of the Swiss Federal Railways — III Engineer, vol. 132, no. 3433, Oct. 14, 1921, pp. 389-390. Sets forth advantages of single-phase system which, it is stated, have been completely confirmed by results of the St. Gothard and Lötschberg lines. Address and more recent observations by Dr. Wyssling.

RAILWAY MOTOR CARS

GASOLINE. Petrol Rail Motor Cars, Kalka-Simla Railway. Ry. Gaz., vol. 35, no. 15, Oct. 7, 1921, pp. 535-539, 7 figs. Describes car for narrow gauge mountain service in India under severe working conditions, due to steep inclines and many sharp curves. Design includes several noteworthy features particularly gearing and transmission, frame construction and combination of coupled wheels and radial trucks to give flexibility on curves.

RAILWAY OPERATION

AUTOMATIC TRAIN CONTROL. Automatic Safety Apparatus and Automatic Train Control (Appareil automatique de sureté et de contrôle des trains). Maurice Gouineau. Revue Générale de l'Electricité, vol. 10, no. 12, Sept. 24, 1921, pp. 406-412, 10 figs. Describes Regan System as adapted to French railroads.
Cab Signalling and Automatic Stopping of Trains (La répétition des signaux sur les machines et l'arrêt automatique des trains), J. Netter. La Technique Moderne, vol. 13, no. 3, March 1921, pp. 101-104, 7 figs. Criticism of Regan system recently tested on Paris-Dreux line; comparison with Rodolausse apparatus; systems used by principal French railroads.

INTERCHANGE OF ROLLING STOCK. On the Question of Interchange of Rolling Stock, C. W. Crawford. Bulletin International Ry. Ass., vol. 3, no. 9, Sept. 1921, pp. 1275-1321. Discusses the question as it affects United States, Canada and Mexico. Gives summary of their regulations and practices, also answers to questions sent. Appendixes.

RAILWAY REPAIR SHOPS

CONTRACT SHOP, VS. The Cost of Contract vs. Railway Shop Repairs, J. W Roberts. Ry. Age, vol. 71, no. 16, Oct. 15, 1921, pp. 729-731, 2 figs. Total cost to railroad was 28 per cent greater in its own shop than in a contract shop.

[illegible]. An Experiment in Railroad Repair Work, Fred H. Colvin. Am March, vol. 55, no. 20, Nov. 17, 1921, pp 807-808. Securing greater interest by local management. Improved machinery and buildings. Describes scheme adopted by Erie R.R. at Hornell, N.Y.

REQUIREMENTS. The Requirements for a Modern Car Repair Shop, H. H. Dickinson and Paul Schioler. Ry. Age, vol. 71, no. 19, Nov. 5, 1921, pp. 890-893, 3 figs. Type of building, character of tools and general plan for both steel and wood equipment.

RAILWAY SHOPS

MACHINE TOOLS FOR. Railway Shop Machine Tool Equipment. British Machine Tool Eng., vol. 1, no. 2, September-October 1921 pp. 277-399, 188 figs. A series of articles on railway shop equipment, including locomotive boiler shop, wheel and axle shop, frame shop, spring shop, grinding shop, general machine shop, capstan and turret lathes, carriage and wagon frames, girder work, etc.

RAILWAY SIGNALING

ALTERNATING-CURRENT. Principles of Alternating Current Signaling, John S. Holliday. Ry. Signal Engr., vol. 14, no. 11, Nov. 1921, pp. 443-45, 9 figs. Explanation of motor and generator motion and transformer action that produces rotation in an induction motor.

BLOCK SYSTEM. Absolute Permissive Block Signal System, C. A. Dunham. Ry. Signal Engr., vol. 14, no. 11, Nov. 1921, pp 438-440, 7 figs. Study of single track signalling showing track layout and circuit diagram and explaining operation of trains between sidings. (Abstract.) Paper read before Kansas City Sectional Committee Meeting.

ELECTRIC. Principles of Alternating Current Signaling, John S. Holliday. Ry. Signal Engr., vol. 14, no. 10, Oct. 1921, pp. 389-390, 12 figs. Explaining an easy method of constructing vector diagrams and the application to track circuit problems.

PROGRESS, AMERICA. Progress of Railroad Signaling in America, H. S. Balliet. Ry. Signal Engr., vol. 14, no. 11, Nov. 1921, pp. 433-437. Detailed history of apparatus and methods used from the days of the smoke blanket to present efficient systems. Paper delivered before N.Y. Signal Sectional Committee.

RAILWAY TIES

HANDLING AND RENEWAL. The Handling and Renewal of Ties. Eng. & Contracting, vol. 56, no. 16, Oct. 19, 1921, pp. 379-380. Notes on estimates for tie renewals, supply and distribution of ties, application of ties in track, and piling and disposition of old ties. Committee report before Roadmasters & Maintenance of Way Assn.

RAILWAY TRACK

CONCRETE SUPPORTS. Concrete Block Track Supports on Italian Railways. Eng. News-Rec., vol. 87, no. 17, Oct. 27, 1921, pp. 689-690, 2 figs. Fixed and rocking blocks placed longitudinally have rail seats at each end. Rockers insure vertical loading.

MAINTENANCE. Distributing Expenditures in Track Maintenance, J. L. Starkie. Ry. Maintenance Engr., vol. 17, no. 11, Nov. 1921, pp. 403-405, 4 figs. Gulf, Colorado & Santa Fe is obtaining increased interest and efficiency by means of new work records
Advantages of Budget System for Track Work, C. A. Morse. Eng. & Contracting, vol. 56, no. 16, Oct. 19, 1921, pp. 370-372. Points out that there should be a carefully prepared budget made up in fall of year including all probable expenditures of coming year outside of ordinary upkeep of track and roadbed. Apportioning amounts covered by budget. Paper presented before Roadmasters & Maintenance of Way Assn.

TURNTABLES. Twin-Span Turntables on the Chesapeake & Ohio. Ry. Rev., vol. 69, no. 18, Oct. 29, 1921, pp. 563-568, 12 figs. Particulars of design and advantages to be realized in use of this type of turntable. Length 100 ft., carrying capacity 450 tons; built by Bethlehem Bridge Corp.; used for heavy Mallet type of locomotives.

RAILWAYS

CONSOLIDATION. Consolidation of Railroads. Ry. Rev., vol. 69, no. 14, Oct. 1, 1921, pp. 423-437, 29 figs. Proposed consolidation of railroad properties of United States into a limited number of systems. Tentative plan of interstate commerce commission based upon Ripley report.

SHANGHAI-NANKING. Notes on the Shanghai-Nanking Railway. Ry. Gaz., vol. 35, no. 18, Oct. 28, 1921, pp. 637-638, 3 figs. Describes general characteristics, standard gage, high-capacity rolling stock, train control, train service, buildings, etc.

REFRACTORIES

FIRECLAYS. Effect of Impurities in Fire Clays, C. E. Bales. Brick & Clay Rec., vol. 59, no. 10, Nov. 15, 1921, pp. 723-725. Points out that high-grade fireclays must be akin to kaolin. Explains coloration processes and neutralizing of harmful ingredients.

FURNACE LINING. Carborundum Linings for Brass Furnaces, M. L. Hartmann Can. Foundryman, vol. 12, no. 10, Oct. 1921, pp. 34-35. Explains how carborundum refractories are applied to problems in crucible, tilting or rotary, and reverberatory furnaces, with records of certain installations. Paper read at Foundrymen's Convention.

RECTIFIERS

MERCURY-ARC Large Mercury Arc Rectifiers. Elec. Rev. (Lond.), vol. 89, no. 2290, Oct 14, 1921, pp 492-493, 3 figs Describes Brown-Boveri rectifier equipments installed at Ipswich, Birmingham and Wolverhampton; capacities, 120 kw at 470-475 volt with primary three-phase a.c at 3000 volts and 50 cycles, and 500 amps at 450 volts with primary three-phase 5000 volts and 25 cycles.

REFUSE DISPOSAL

INCINERATORS FOR MILL. Incinerator for Mill Refuse Made of Brick and Concrete. Eng. News-Rec., vol. 87, no. 18, Nov. 3, 1921, pp. 727-728, 1 fig. Consists of concrete shell with fire brick lining, 14 ft. in diam. at base and 60 ft. high, built at cost of $6000. Air vents and expansion joints increase life of materials under high heat.

RIVETED JOINTS

EFFICIENCY. A Criticism of High Efficiency Riveted Joints, John S. Watts. Boiler Maker, vol. 21, no. 10, Oct. 1921, pp. 278-279, 3 figs. Calculations indicate that use of multiple riveted joints does not increase seam efficiencies.

ROAD CONSTRUCTION

STANDARD COST ESTIMATE. Standard Estimate of Cost Form for Road Construction. Eng. & Contracting, vol. 56, no. 18, Nov. 2, 1921, pp. 410-411. Presents standard estimate of cost form prepared by Kentucky Assn. Highway Contractors, in which it is attempted to place squarely before bidder every item of cost ordinarily encountered.

ROADS

SUBGRADE DRAINAGE. Bureau of Roads' Subgrade Drainage Tests Give Inetresting Data. Ira B. Mullis Eng. & Contracting, vol. 56, no. 18, Nov. 2, 1921, pp. 407-409, 3 figs. Account of results obtained from subgrade drainage experiments in progress at Arlington, Va., since fall of 1920. Abstracted from Public Roads.

WATERPROOFING SURFACES. Waterproofing Road Surfaces. Can. Engr., vol. 41, no. 17, Oct. 27, 1921, pp. 4 and 9. Discussion before Eng. Inst. of Can. on present methods of obtaining waterproof roadway surfaces.

ROADS, CONCRETE

CENTRAL MIXING. Central Mixing for Concrete Roads, C S Hill Eng. News-Rec., vol. 87, no. 16, Oct. 20, 1921, pp. 636-637. Conclusions of two years' experience in concrete road construction by central mixing and wet-batch haulage show that where conditions favor their use, they are an economical method of concrete road construction

DOUBLE-SLAB. New York Develops Double-Slab Concrete Roads. Eng. News-Rec., vol. 77, no. 20, Nov. 17, 1921, pp. 804-805, 4 figs. Parallel concrete slabs separated by macadam give three-way road at cost of single two-way slab.

NEW CONSTRUCTION METHOD. A New Method of Making Concrete Roads. Engineer, vol. 132, no. 3435, Oct. 28, 1921, pp. 465-466, 4 figs. In system patented by J. H. Walker , he adopts principle of laying concrete in alternate bays, and not filling in intervening spaces until material in bays has set and undergone greater part of its contraction; he furthermore makes edges of bays accurately vertical by means of special formers which are described.

REINFORCING STEEL FOR. Reinforcing Steel for Road Use, Charles W. Geiger. Iron Age, vol. 108, no. 19, Nov. 10, 1921, pp. 1222-1223, 8 figs. Test highway built by Columbia Steel Co., to study methods of reinforcement. Special device for laying steel.

ROADS, MACADAM

RESURFACING. Resurfacing and Treating of Macadam Roads, T. J. Wasser. Can. Engr., vol. 41, no. 17, Oct. 27, 1921, pp. 10, 11 and 12. States that Resurfaced roads must be underdrained to allow escape of sub-surface water. Specifications for converting road foundations for bituminous pavements.

ROLLING MILLS

BAR MILLS FOR ALLOY STEEL. Adapts Bar Mills to Alloy Steel, J. D. Knox. Iron Trade Rev., vol. 69, no. 20, Nov. 17, 1921, pp. 1275-1281, 12 figs. New 12 and 18-in. merchant units installed by Ohio steelmaker rounds out rolling equipments. Unique guide box prevents scrap loss. Rolls adjusted by set screws. Description of mills.

ELECTRICALLY DRIVEN. Some Methods of Obtaining Adjustable Speed With Electrically Driven Mills. K. A. Pauly. Proc. Engrs.' Soc. of Western Pa., vol. 37, no. 3, April 1921, pp. 158-178 and (discussion) 179-188, 19 figs. Discusses rolling mill practice, speed of rolling and systems of speed control.

S

SCIENTIFIC MANAGEMENT

See Industrial Management.

SEMI-DIESEL ENGINES

OPEN-CRANKCASE. The Open-Fronted Surface Ignition Engine, F. G. Butt-Gow. Trans. Inst. Mar. Engrs., vol. 33, Sept. 1921, pp. 239-269 and (discussion) 270-279, 22 figs. Discusses closed and open engines and compares cost of manufacture, running, overhauling lubrication, etc. Describes various types of open-crankcase engines.

SEWAGE

SCREENS, REINSCH-WURL. Tests of Reinsch-Wurl Screens at Dyckman St. Sewage Screening Plant, New York, Kenneth Allen. Eng. & Contracting, vol. 56, no. 19, Nov. 9, 1921, p. 434. Results of tests with day and night sewage, indicate that screen with 1116-in. slots will remove about 7110 as much material under given conditions as screen with 3164-in. slots. (Abstract) Paper read before Am. Soc. Mun. Improvements.

TRICKLING FILTERS. Non-Bacterial Population of Sewage Trickling Filters, Charles R. Cox. Eng. News-Rec., vol. 87, no. 18, Nov. 3, 1921, pp. 720-725. Review of literature and observations at three Maryland plants indicate that vegetable growths are more harmful than helpful and animal growths harmless or beneficial. Methods of control.

SEWAGE DISPOSAL

IMHOFF TANKS. Operations of Imhoff Tanks at Fitchburg, Mass. David A. Hartwell. Eng. & Contracting, vol. 56, no. 19, Nov. 9, 1921, pp. 439-441. Data on operation of sewage-disposal plant including five Imhoff tanks each 30 by 90 ft. in plant and 26 ft. deep. Notes on cleaning and sludge disposal of tanks, trickling filter, etc.

LOW SEWER GRADES AND. Sewer Grades and Sewage Disposal, Arthur J. Martin. Eng. News-Rec., vol. 87, no. 16, Oct. 20, 1921, pp. 638-640. British view on dilution standards, activated by spiral movement, low sewer velocities and sewage utilization.

SLUDGE REMOVAL. Sludge Removal at Sewage Disposal Plant at Rochester, N.Y., N. Adelbert Brown. Eng. & Contracting, vol. 56, no. 19, Nov. 9, 1921, pp 144. Notes on cost of sludge removal and use of sludge as fertilizer. Paper read before Am. Soc. Mun. Improvements.

SHAPERS

TOOLROOM WORK. A New Shaping Machine. Eng. Production, vol. 3, no. 55, Oct 20, 1921, p. 372, 3 figs. Describes machine introduced by the Butler Machine Tool Co., Ltd., Halifax, designed especially for toolroom work.

SHIP DESIGN

DOUBLE BOTTOM. A New System of Double-Bottom Construction. Shipbldg. & Shipg. Rec., vol. 18, no. 12, Sept. 22, 1921, pp. 368 and 373-374, 4 figs. Detail of G. A. system developed by D. B. Gebbie and T. B. Abell.

SILICA BRICK

MANUFACTURE. Experimental Work in Connection with the Manufacture of Silic Brick, A. W. McMaster. Jl. Eng. Inst. Can., vol. 4, no. 11, Nov. 1921, pp 561-565, 6 figs. Development of new industry in Nova Scotia by Dominio Iron & Steel Co. Ltd.

THERMAL EXPANSION Reversible Thermal Expansion of Silica, H. S. Houldsworth and J. W. Cobb. Iron & Coal Trades Rev., vol. 103, no. 2797, Oct. 1921, pp. 508-509. Describes experiments with commercial silica bricks, rat of expansion at various temperatures; layer formation in bricks; et (Abstract) Paper read before Refractory Matls Section of Ceramic So

SPRINGS

COIL. The Manufacture of Coil Springs, A. W. Allen. Machinery (Lond.), vo 19, no. 474, Oct. 27, 1921, pp. 85-89, 17 figs. Coiling machines; open cc barrel springs; press operations; eye forming; cutting, eyeing and bowing.

COMPRESSION. Nested Steel Compression Springs, T. F. Stacy. Am. Mach vol. 55, no. 20, Nov. 17, 1921. pp. 795-796, 2 figs. Deals with design of co centric springs so proportioned that all springs are worked to maximum fib stress.

DESIGN. The Design of Springs, Joseph Kaye Wood. Am. Mach., vol. 55, no. 1 Oct. 27, 1921, pp. 674-677, 10 figs. Control of the "spring criterion" Fc mulas for leaf springs constrained at one or both ends. Characteristics of co spiral and buffer springs.

A general Method for Spring Design, Joseph Kaye Wood. Am. Mach vol. 55, no. 19, Nov. 10, 1921, pp. 757-762, 3 figs. Types of springs. Ec nomy index and load-deflection rate. General formulas and table of co stants Parallel scale chart Importance of material index.

STANDARDIZATION

AUTOMOBILE INDUSTRY. Industrial Standardization, Geo. W. Watson. Automob Engr., vol. 11, no. 155, Oct. 1921, pp. 356-358. Advocates more standa ization in British automobile industry, including agricultural tractors, e Résumé of presidential address before Instn. of Automobile Engrs.

STANDARDS

GERMAN V D I REPORT. Report of the German [illegible] Standards. Mitteilungen des Normenausschusses der Deutschen Industrie. Betrieb, vol 3, no 25, Sept 15, 1921, pp 367-379, 18 figs. [illegible] cylinder, round-head, and countersunk [illegible] Board of Directors for drawings for recording dimensions; straight wooden stairs for small dwellings, window and door [illegible].

Report of the German Industry Committee on Standards. Mitteilungen des Normenausschusses der Deutschen Industrie. Betrieb, vol. 3, no. 26, Sept. 25, 1921, pp 393-406, 21 figs. and supp. [illegible] Proposals of Board of Directors for ball bearings. Proposed [illegible] for boiler and structural steel work, [illegible] and countersunk, oval heads.

STEAM

CALLENDAR EQUATIONS. The Callendar Equations for Steam, Gerard Stoney. Beama, vol 9, no 4, Oct 1921, pp 345-350 [illegible] figs. Abstract of some of the best and easiest ways in which to use these equations with special reference to steam turbine practice.

PRODUCTION AND DISTRIBUTION ACCOUNTING. Accounting for Steam Production and Distribution, A. R. Smith. Power, vol. 54, no. 17, Oct. 25, 1921, pp. 630-633, 1 fig. Describes two forms of balance sheets and enumerates possible losses which can be detected by their use. Ways and means and advantage of metering boiler outputs.

STEAM-ELECTRIC PLANTS

DIAGRAMMATIC RECORDING IN. How Can the Executive Keep in Touch with Plant Economy? C. H. Delany. J. Electricity & Western Industry, vol. 47, no. 7, Oct. 1, 1921, pp. 267-268, 4 figs. Diagrammatic method of recording results in operation of a steam electric power plant.

STEAM ENGINES

UNIFLOW. A 200 hp. Uniflow Steam Engine. Power House, vol. 14, no. 18, Sept. 20, 1921, pp. 21-23, 4 figs. Built by Galloways Ltd., Manchester. Has a novel high-speed valve gear and compression release.

See also Locomotives.

STEAM PIPES

REDUCING RESISTANCES IN. Economies Obtainable by Reducing Resistances in Steam Piping. O. Denecke. Mech. Eng., vol. 43, no. 11, Nov. 1921, pp. 735-738, 2 figs. Discussion of general principles on which design of steam piping in power plants should be based, with comparison of formulas suggested for various elements affecting steam consumption as function of resistances encountered to flow of steam. Translated from Zeit. für Dampfkessel u Maschinenbetrieb.

STEAM POWER PLANTS

MODERN DESIGN. Modern Steam Power Station Design. Frank S. Clark. Jl. Franklin Inst., vol. 192, no. 4, Oct. 1921, pp. 413-452, 11 figs. Notes on present status of turbine design; economical and mechanical features of station design; operation of plant.

STEEL

ARTIFICIAL SEASONING. Artificial Seasoning of Steels. H. J. French. Am. Mach., vol. 55, no. 19, Nov. 10, 1921, pp. 768-771. Review of available data on length changes and spontaneous generation of heat in hardened steels. Results of preliminary experiments on artificial seasoning. Printed by permission of Bur. of Standards.

AUTOMOBILE GEAR. Investigation of Tooth Wear With Various Gear Steels. E. R. Ross. Automotive Industries, vol. 45, no. 18, Nov. 3, 1921, pp. 865-869, 10 figs. Steel with minimum of 0.45 carbon that is capable of treatment giving a scleroscope hardness of 75 or over is recommended for oil treating. Specification limits should be close enough to insure uniform results from a standard heat treatment.

BAR, WEIGHT OF. Estimating the Weight of Bar Steel. Hyman. Iron Age. Machy. (N.Y.), vol. 28, no. 3, Nov. 1921, p. 190. Formulas for calculating approximate weights of various sections and lengths of steel.

CAST, CARBONIZING PARTS. The Carbonizing of Cast Steel Parts, William G. Conner. Trans. Am. Soc. for Steel Treating, vol. 2, no. 2, Nov. 1921, pp. 148-149. Writer finds that all parts or pieces should be cooled in pots to atmospheric temperature.

CAST, IMPACT TESTS ON. Study Impact Tests on Cast Steel. [illegible] Iron Trade Rev., vol. 69, no. 18, Nov. 3, 1921, pp. 1145-1147 and 1154, 6 figs. Results of investigations on cast steels of varied compositions and heat treatments. Higher shock strength is shown to be obtained from low phosphorus material.

IMPACT PROPERTIES. Impact Properties of Various Steels. [illegible] Chem. & Met. Eng., vol. 25, no. 20, Nov. 16, 1921, pp. 910-912, 5 figs. Cylinders of steel, centrifugal cast, were sectioned and tested, a set of steel bars, with increasing carbon content, and some steel casting were tested after various heat-treatments; comparison of impact for forged and cast steels.

NITROGEN IN CARBURIZED. Nitrogen in Carburized Steels, W. E. Ruder and G. E. Brophy. Chem. & Met. Eng., vol. 25, no. 19, Nov. 9, 1921, pp. 867-871, 7 figs. Describes micrographic methods for detection of nitrogen compounds.

PROPERTIES. The Properties of Steel. Eng. Production, vol. 3, no. 57, Nov. 3, 1921, pp. 417-418, 1 fig. Notes on influence of various elements.

STAINLESS. Stainless Steel in Engineering. Eng. & Ind. Management, vol. 2, no. 17, Oct. 27, 1921, pp. 466-467, 2 figs. Describes demonstration at Thos. Firth's & Sons, Sheffield, England, showing behavior of turbine blades, made from stainless steel under working conditions. See also Eng. Production, vol. 3, no. 56, Oct. 27, 1921, p. 405, 2 figs.; Engineering, vol. 112, no. 2913, Oct. 28, 1921, pp. 592-594, 7 figs.; and Engineer, vol. 132, no. 3435, Oct. 28, 1921, pp. 447-450, 7 figs.

See also Iron and Steel; Chromium Steel; Manganese Steel; Vanadium Steel.

STEEL CASTINGS

HEAT TREATMENT. Heat Treatment Improves Castings, Martin M. Rock. Foundry, vol. 49, no. 20, Oct. 15, 1921, pp. 797-799. Tensile tests of unannealed, air cooled and water quenched steel castings do not disclose marked difference in strength but impact tests show water-quenched product excels others.

STEEL, HEAT TREATMENT OF

HARDENING. Discussion of the Hardening of Steel and other Alloys, Oscar E. Harder. Trans. Am. Soc. for Steel Treating, vol. 2, no. 2, Nov. 1921. pp. 139-147, 1 fig. With particular emphasis on important part played by solution and precipitation.

HARDNESS VARIATIONS. Hardness Variations in Heat-Treated Steel, Carle R. Hayward. Chem. & Met. Eng., vol. 25, no. 15, Oct. 12, 1921, pp. 695-696. Gives some tables of figures for shore center and half-way tests showing greater hardness in center.

INFLUENCE OF MASS. A Contribution to the Problem of the Influence of Mass in Heat Treatment, E. J. Janitzky. Trans. Am. Soc. for Steel Treating, vol. 2, no. 1, Oct. 1921, pp. 55-62, 3 figs. Writer seeks to show that law which relation of mass has to physical properties exists and can be determined mathematically.

QUENCHING. Efficiency of Various Quenching Mediums With Their Practice and Applications, James B. Morey. Trans. Am. Soc. for Steel Treating, vol. 2, no. 1, Oct. 1921, pp. 63-69, 4 figs. Discusses effect of brine, oil, sperm, lard, [illegible] or salt water.

STEEL, HIGH-SPEED

ELECTRIC TOOL. Features of Electric Tool Steel Practice, W. J. and S. Stuart Green. Iron Age, vol., 108, no. 17, Oct. 27, 1921, pp. 1061-1064, 3 figs. Points out that Standardized shop practice is necessary. Large ingots are recommended. Top pouring preferred for tool steel.

TREATMENT. How to Make the Most out of High Speed Steel, A. J. Wilson. Can. Machy., vol. 26, no. 13, Sept. 29, 1921, pp. 35-36. Steel must be heated uniformly. Tools should not be hardened direct from forging operation. Should be annealed.

TUNGSTEN CONTENT, EFFECT OF. Effect of Tungsten Content on the Specific Gravity of High Speed Steel, Arthur S. Townsend. Trans. Am. Soc. for Steel Treating, vol. 2, no. 2, Nov. 1921, pp. 133-138. Observations made in writer's laboratory tend to establish general rule for annealed steels that the higher the tungsten content the higher the specific gravity.

STEEL MANUFACTURE

ENAMELED STEEL. Enameled Steel Manufacture, Chester H. Jones. Chem. & Met. Eng., vol. 25, no. 19, Nov. 9, 1921, pp. 883-886, 9 figs. Development of glass-lined steel containers; fabricating and finishing the steel; mixing and firing the enamel.

STEEL WORKS

ELECTRICAL DEVELOPMENT IN. Electrical Development in Steel Mills, R. B. Gerhardt. Iron Age, vol. 108, no. 18, Nov. 3, 1921, pp. 1135-1136. Report of progress during past year. Advance in control equipment.

FRENCH, REBUILDING. French Modernize in Rebuilding, L. Guillet. Iron Trade Rev., vol. 69, no. 18, Nov. 3, 1921, pp. 1152-1154. Better equipment than was used before installed in iron and steel works. Products of American engineering skill used in some plant. Résume of restoration, (Abstract.) Paper before British Iron & Steel Inst.

STELLITE

USE FOR CUTTING TOOLS. Stellite and Its Use for Cutting Tools (Le "Stellite" et son emploi pour les outils de tour). L'Ouvrier Moderne, vol. 4, no. 6, Sept. 1921, pp. 227-230, 26 figs. Properties of stellite, degrees of hardness, operating tools, etc.

STOKERS

ELVIN MECHANICAL. Distinctive Features of the Elvin Mechanical Stoker. Ry. & Locomotive Eng., vol. 34, no. 10, Oct. 1921, pp. 259-264, 10 figs. Details of its construction and operation, and improvements made without changing fundamental principles of its design. Applied to Mallet locomotives.

STREET RAILWAYS

PAVEMENT AND TRACK SPECIFICATIONS. Proposed Specifications for Street Railway Pavements and track Construction, Charles E. De Leuw. Eng. & Contracting, vol. 56, no. 18, Nov. 2, 1921, p. 412. Specifications proposed by committee before Am. Soc. Mun. Improvements.

SWITCHBOARDS

METER CONNECTIONS. Switchboard-Meter Connections — Common Types of Alternating-Current Instruments, E. A. Reinman. Power, vol. 54, no. 17, Oct. 25, 1921, pp. 625-628, 12 figs. Wiring for frequency meters, power- and reactive-factor meters and synchroscopes on single- and three-phase circuits.

T

TERMINALS, RAILWAY

SNOW AND ICE HANDLING. Handling Snow and Ice in Railway Terminals, J. J. Navin. Eng. & Contracting, vol. 56, no. 20, Nov. 16, 1921, pp. 462-463. (Abstract.) Paper read before Maintenance of Way Club of Chicago.

TEXTILE MACHINERY

CONSTRUCTION. Machining Operations on Textile Machine Parts. Machinery (Lond.), vol. 19, no. 473, Oct. 20, 1921, pp. 57-62, 14 figs. Review of methods employed by British Northrop Loom Co., Ltd., Daisyfield, Blackburn.

TEXTILE MILLS

VENTILATION. Ventilation and Humidification of Textile Factories, H. N. Leask. Domestic Eng. (Lond.), vol. 41, no. [illegible], Oct. 1921, pp. 155-159, 1 fig. Describes an apparatus designed by A. B. Cleworth meeting all the requirements of humidity and ventilation, etc. Extract from paper read before Rochdale Cotton Spinners' Mutual Improvement Soc.

TIDAL POWER

SYSTEM FOR UTILIZING. Long Distance Transmission of Electrical Energy with Special Reference to Tidal Power, T. F. Wall. Engineering, vol. 112, no. 2912, Oct. 21, 1921, pp. 587-588, 3 figs. Preliminary outline of system obviating difficulty of varying speeds of turbines, permitting use of a-c. generators driven directly from turbines and offering other advantages. Paper read before British Assn.

TIMBER

JOIST AND RAFTER SPANS. Maximum Joist and Rafter Spans, L. P. Keith. Contract Rec., vol. 35, no. 45, Nov. 9, 1921, pp. 972-973. Presents tables which facilitate determination of lengths of timbers for load conditions encountered in ordinary construction.

STRUCTURAL, DECAY IN. The Cause and Prevention of Decay in Structural Timber, R. J. Blair. Jl. Eng. Inst. Can., vol. 4, no. 11, Nov. 1921, pp. 565-568, 6 figs. Fungus is said to be cause of timber decay; factors influencing growth of fungus; methods for preventing decay and preserving timber.

TIME STUDY

STOP-WATCH. Stop Watch Time Study. Does It Promote Industrial Efficiency? Eng. & Indus. Management, vol. 6, nos. 16 and 17, Oct. 20 and 27, 1921, pp. 437-440 and 463-465. Oct. 20: An indictment of the Stop Watch, by Frank B. and L. M. Gilbreth. Defense of stop watch by Carl G. Barth and Dwight V. Merrick in discussion held under auspices of Taylor Society.

TRACTORS

NEW MODELS. British Tractor Trials Develop Interesting Engineering Features, M. W. Bourdon. Automotive Industries, vol. 45, no. 17, Oct. 27, 1921, pp. 817-822, 13 figs. American-made machines received favorable comments and a number of new models were introduced at British exhibitions.

TUBES

COPPER. Copper Tubes Produced by Cold Extrusion Process, A. Ludlow Clayden. Raw Material, vol. 4, no. 9, Sept. 1921, pp. 314-315, 5 figs. Describes method of producing thin-wall copper tubes, developed from experience gained in the production of rifle shells during war.

SEAMLESS COPPER. Copper Tube Extrusion and the Manufacture of Radiator Cores, Herbert Chase. Automotive Industries, vol. 45, no. 18, Nov. 3, 1921, pp. 870-873, 8 figs. How seamless tubes are formed from solid stock by cold extrusion, shaped with hex ends and baffles, tested under pressure and finally assembled and soldered into complete radiator cores. Describes apparatus for determining relative efficiency of various types of cores.

WELDED MANUFACTURE. Welded Tube Manufacture Iron Age, vol. 108, no. 20, Nov. 17, 1921, pp. 1274-1276, 7 figs. Machinery required for tubes ⅜ to 4 in. in diam. from sheets of no. 10 and no. 22 gage.

TUNNELS

LINING. Lining Tunnels Under Traffic. Ry. Maintenance Engr., vol. 17, no. 11, Nov 1921, pp. 415-418, 3 figs. Discusses hand method and pneumatic method; describes some pneumatic lining done by Southern Pacific; details of operations and cost.

LINING RAILWAY. Methods of Lining Railway Tunnels Under Traffic. Eng. & Contracting, vol. 56, no. 20, Nov. 16, 1921, pp. 456-459. Notes on lining tunnels by hand methods and by pneumatic method; getting aggregate to mixer; mixer plant; placing concrete; labor organization and cost. Methods employed by different railroads. Committee report before Am. Ry. Bridge & Building Assn.

U

UNEMPLOYMENT

[illegible]. What Construction Can Do for the Unemployed, R. C. Marshall. Eng. & Contracting, vol. 56, no 16, Oct. 19, 1921, pp. 378-379. [illegible] the unemployment emergency, and discusses steps for reviving construction. Memorandum submitted to President's Unemployment Conference.

UNIVERSAL JOINTS

[illegible] Pressed Steel Housing for a Universal Joint [illegible] 17, 1921, pp. [illegible], 8 figs. Method of producing small automobile parts. Series of stamping operations. Des[illegible]

URANIUM STEEL

MICROSTRUCTURE. Uranium Steels, Hugh S. Foote, Chem. & Met. Eng., vol. 25, no. 17, Oct. 26, 1921, pp. 789-792, 13 figs. Discussion of microstructure of [illegible] percentages of uranium. Brief description of influence of uranium as an alloy in structural and high-speed steels.

V

VENTILATION

INDUSTRIAL. Industrial Ventilation, R. L. Gould and E. L. Hewitt. Am. Mach. vol. 55, no. 20, Nov. 17, 1921, pp. 792-795, 3 figs. Relation of ventilation to efficiency. Various methods of natural and artificial ventilation.

VENTURI METERS

HERSHEL. The Hershel Venturi Meter (Il Venturimetro Herschel). Giornale del Genio Civile, vol. 59, July 31, 1921, pp. 439-448, 2 figs. Discusses its principle experimental verifications and practical application.

W

WAGES

LIMITATION OF OUTPUT. Limitation of Output, H. M. Vernon. Eng. & Indus. Management, vol. 6, no. 16, Oct. 20 1921, pp. 428-432, 3 figs. Based on chapter in writer's recently published book on industrial Fatigue and Efficiency. Includes statistical information obtained during war and now published for first time. Discussion as to what is best form of wage and piece-rate payment.

PROBLEMS. Wages Problems. Iron & Coal Trades Rev., vol. 103, no. 2794, Sept. 16, 1921, pp. 395-397. Paper by W. L. Hichens on "The Principles by which Wages are Determined" and paper by Prof. Kirkaldy on "The Wages System and Possible Developments." See also Colliery Guardian, vol. 122, no. 3168, Sept. 16, 1921, pp. 797-798 and p. 805.

SYSTEMS. A Wage System. Eng. & Indus. Management, vol. 6, no. 17, Oct. 27, 1921, pp. 468-469. Describes system in use in large American works which, it is claimed, contains many points of suggestive value meriting wider adoption and application.

WASTE HEAT

INSTALLATION AT CEMENT PLANT. Waste Heat Installation at Cement Plant Rock Products, vol. 24, no. 23, Nov. 5, 1921, pp. 13-17, 14 figs. Trinity Portland Cement Co., Dallas, Texas, erects waste-heat power plant at cost of over half a million dollars. Entire plant run by waste heat from kilns.

UTILIZATION. Waste Heat Utilization for Steam Generation, G. R. McDermott. Blast Furnace & Steel Plant, vol. 9, no. 10, Oct. 1921, pp. 607-613. Discusses sources of waste heat and waste-heat boilers of several types. (Abstract.) Paper read at Assn. of Iron & Steel Elec. Engrs. Convention.

WATER POWER

DEVELOPMENT IN WEST. Future Water Power Development Problems of the West, F. G. Baum. Jl. Electricity & Western Industry, vol. 47, no. 6, Sept. 15, 1921, pp. 221-223, 6 figs. Analysis of Western power resources and some new angles on the possibilities of 220,000-volt transmission.

WATER PIPES

STRESSES IN LARGE HORIZONTAL. Stress Coefficients for Large Horizontal Pipes, James M. Paris. Eng. News-Rec., vol. 87, no. 19, Nov. 10, 1921, pp. 768-771, 20 figs. Various elementary kinds of loading separately considered and adaptable by proper combination to actual loadings under any condition of support and surcharge.

WATER SUPPLY

AMERICAN STANDARDS. American Standards for Quality of Water, J. J. Hinman Jr. Jl. Soc. Chem. Industry, vol. 40, no. 17, Sept. 15, 1921, pp. 325R-327R. Discusses American Standards of water supply and gives tables of standards of state water laboratories and of plant operation.

WATER WORKS

SAND AND ICE IN INTAKES. Study of Sand and Ice Conditions at Water Intake. C. M. Daily. Eng. & Contracting, vol. 56, no. 19, Nov. 9, 1921, p. 435, 3 figs. Report of investigation on experimental intake tower and channel to determine action of ice and sand.

WINNIPEG, CAN. The New Winnipeg Waterworks, Frank W. Skinner. Engineering vol. 112, nos. 2913 and 2914, Oct. 28 and Nov. 4, 1921, pp. 589-591 and 621-624, 18 figs. Notes on design and location, type of aqueduct, intake, arch design, surge tank, culverts, construction railroads, drainage, concreting pipe manufacture and casting, etc.

WELDING

HAMMER. Hammer-Welding Plant of the Blaw-Knox Co., Ernest Edgar Thum. Chem. & Met. Eng., vol. 25, no. 16, Oct. 19, 1921, pp. 747-751, 8 figs. New plant and process for making large seamless tanks and sheet-steel vessels described by tracing course of an 8-ft. boiler shell of ⅝-in. plate through its manufacture.

See Electric Welding, Arc.

WELDS

TESTING. A Standard for Testing Welds. Ry. Jl., vol. 27, no. 10, Oct. 1921, pp. 14-19, 14 figs. Report of committee appointed by Am. Welding Soc. Discusses shop, commercial and research standards of tests, test specimens and machines.

Engineering Index

This Index is prepared by the American Society of Mechanical Engineers.

In this department will be published from month to month the titles of current engineering papers with the authors and source and a brief extract of the more important. It is designed to give the members of The Institute a survey of all important articles relating to every branch of engineering profession.

A

ACCOUNTING

POWER PLANTS. Power-Plant Accounts, Wilfred A. Miller. Power, vol. 54, nos. 16, 17, 18, 19, 20, 21, 22, 23, 24 and 25, Oct. 18, 25, Nov. 1, 8, 15, 22, 29, Dec. 6, 13 and 20, 1921, pp. 596-599, 636-638, 680-684, 719-723, 769-772, 805-809, 848-852, 891-894, 934-936 and 979-980, 59 figs. Oct. 18. How to record indirect expenses. Oct. 25: Interest on borrowed money, profit and related subjects, Nov. 1: Considerations in buying equipment; meaning of depreciation. Nov. 8: Power plant as manufacturing department. Nov. 15: "Income" and "profit and loss" accounts. Nov. 22: The "surplus" account. Nov. 29: Debit and credit the cost account. Dec. 6: Closing ledger accounts. Dec. 13: Investment account and reserve for depreciation and obsolescence. Dec. 25: Scrapping equipment. (Continuation of serial.)

AIR COMPRESSORS

REGULATION. The Regulation of Air Compressors, Power, vol. 54, no. 24, Dec. 13, 1921, pp. 918-921, 11 figs. Discusses various arrangements used to control amount of air delivered by compressor.

AIR CONDITIONING

CHEMICAL PROCESSES. Notes on the Relation of Atmospheric Conditions to Chemical Processes, A. E. Stacey. Jl. Am. Soc. Heating & Ventilating Engrs., vol. 27, no. 8, Nov. 1921, pp. 777-781, 3 figs. Gives a few typical examples of need of air conditioning in chemical industry.

AIRPLANE ENGINES

CARBURATORS. *See Carburators.*

CYLINDERS. Preliminary Calculation of Cylinder Dimensions for Aircraft Engines, Otto Schwager. Aerial Age Weekly, vol. 14, no. 8, Oct. 31, 1921, pp. 179-180 and 187. Method described depends on air requirement of fuel. Gives examples for water-cooled, air-cooled and rotary engines. Translated from Zeit. fur F. & M., Dec. 31, 1920.

FUEL. The Problem of Fuel for Aviation Engines, Aerial Age Weekly, vol. 14, no. 1, Sept. 12, 1921, pp. 8-11 and 22-23, 6 figs. Technical note of Nat. Advisory Committee for Aeronautics. Discusses composition, quantity available, price per heat unit, stocks of fuel at aerial ports, preparation of fuel mixtures, carburetor function, etc. Lecture given by Prof. Kutzbach.

GEAR PUMP. Performance of a Vane-Driven Gear Pump. R. H. Heald. Aerial Age, vol. 14, no. 4, Oct. 3, 1921, pp. 81-83 and 90, 8 figs. Gives results of tests with pumping unit driven by a wind wheel in air stream during flight, for pumping gasoline to tank in upper wing from which it flows by gravity.

RADIATORS. Cooling System Test of the Curtiss JN-6 with Packard 1A-744 Engine Equipped with Side Radiators. Air Service Information Circular, vol. 3, no. 294, Oct. 20, 1921, 12 pp. 8 figs. Result of test to determine effectiveness of side radiators.

AIRPLANES

IMPROVING PERFORMANCE. Means for Improving Airplane Performance, Harlan D. Fowler. Aviation, vol. 11, no. 23, Dec. 5, 1921, pp. 652-655, 14 figs. Discusses aerofoils, combining high speed with large load, variable area, etc.

LOAD FACTORS. Effect of Variation in Load Factor on Structural Weight of Wings, R. A. Miller. Aerial Age Weekly, vol. 14, no. 8, Oct. 31, 1921, pp. 177-178, 1 fig. Concludes that area of spars varies directly with load factor, area of struts varies with load factor and increases at slightly smaller rate than load factor, etc

MULTI-ENGINED. Multi-Engined Commercial Airplanes, Donald W. McIlhiney. Aviation, vol. 11, no. 18, Oct. 31, 1921, pp. 506-507. Gives table of principal data of 44 such airplanes, and discusses main points.

SPEED METERS. N.A.C.A. Recording Air Speed Meter, F. H. Norton. Aerial Age Weekly, vol. 14, no. 7, Oct. 24, 1921, pp. 151 and 154, 7 figs. Describes new type designed by technical staff of Nat. Advisory Committee for Aeronautics, consisting of a tight metal diaphragm of high natural period which is acted upon by the pressure difference of a pilot-static head.

STAGGERING OF BIPLANE. The Effects of Staggering a Biplane, F. H. Norton. Aerial Age Weekly, vol. 14, no. 5, Oct. 10, 1921, pp. 103-104, 5 figs. The lift, drag and center of pressure travel are determined for a biplane with a stagger varying from—100 per cent to + 100 per cent.

STATIC TEST. Report of Static Test on Engineering Division Messenger Airplane. Air Service Information Circular, vol. 3, no. 270, Oct. 1, 1921, 15 pp. 10 figs. Particulars of tests carried out at McCook Field, Dayton, Ohio, to determine strength of wings, ailerons, empennage, fuselage, and chassis.

STORAGE OF PARTS. Instructions for the Storage of Airplanes Engines, Their Parts and Accessories. Air Service Information Circular, vol. 3, no. 256, July 15, 1921, 9 pp. Deals with storage of wooden airplane parts, airplane materials, engines, armament, equipment and propellers. Specifications covering requirements of Air Service for rust-preventing compound for protection against corrosion of aircraft engine.

STRUTS. Tests on Combined Loading of Wooden Struts. Air Service Information Circular, vol. 3, no. 276, Oct. 1, 1921, 11 pp. 5 figs. Results of investigation to determine whether test data obtained when a wooden strut is subjected to a column load and also to a side or lateral bending load verify formulas now in use.

TESTS. Aerodynamical Report and Tests on the Eggleston Air-Cell Giant Biplane. Aerial Age Weekly, vol. 14, no. 14, Dec. 12, 1921, pp. 323-324 and 326, 4 figs. Report of tests carried out at wind speed of 30 m.p.h. by Cox-Klemin Aircraft Corp., College Point, L. I.

TRUSS RIBS. Experimental Reinforced Plywood Truss Ribs, B. C. Boulton. Aerial Age Weekly, vol. 13, no. 25, Aug. 29, 1921, pp. 591-594, 17 figs. Gives tables of data for rib design and direct stresses in rib trusses. Test data on 15 ft. truss ribs. (Concluded).

See also Flying Boats; Seaplanes.

AIRSHIPS

MOORING. The Mooring of Airships, G. H. Scott, Flight, vol. 13, no. 48, Dec. 1, 1921, pp. 803-04. Discusses mooring on surface of land or water; mooring in the air on one or more wires, and towing; and mooring at a mast. Extract of paper read before Cambridge Univ. Aeronautical Soc.

NON-RIGID, STRESSES IN. Bending Moments, Envelope, and Cable Stresses in Non-Rigid Airships, C. P. Burgess. Nat. Advisory Committee for Aeronautics report no. 115, 1921, 14 pp., 4 figs. Describes theory of calculations and methods in use in U.S. Navy Bur. of Aeronautics. Principal stresses are said to be due to gas pressure and unequal distribution of weight and buoyancy, and concentrated loads from car suspension cables. Deals also with variations of tensions in car suspension cables of any type of airship, with reference to rigid type, due to propeller thrust or inclination of airship longitudinally.

ALLOY STEELS

Cracking During Dip Brazing. Report on Cause of Cracking of Alloy Steel During Dip Brazing. Air Service Information Circular, vol. 3, no 295, Oct. 20, 1921, 3 pp 2 figs. Results of investigation show that two influences contribute to cracking, namely, a sudden rise in temperature after immersion in brass, a sharp [illegible] cross-section [illegible] in specimen. Slow preheating to brazing temperature is said to obviate this difficulty

Impact Tests. Effect of Repeated Impact on Steels. (Influence des chocs repétés à la compression sur les aciers), Fernand Eloy. Revue de l'Industrie Minérale, no. 19, Oct 1, 1921, pp 603-606. Discusses tests with special and carbon steels, showing superiority of former.

Tool Steel. Tool-Steel Specifications—A Hard Nut to Crack, Charles M. Brown. Raw Material, vol. 4, no. 10, Oct. 1921, pp. 349-352. Advocates formulation of definite standards as an advantage from user's point of view.

ALLOYS

Carbon-Chromium-Silicon. A New Carbon-Chromium-Silicon Resistance Material. Raw Material, vol. 4, no. 10, Oct. 1921, pp. 359-361, 4 figs. Discusses physical properties of "Silchrome" and gives results of tests made at Columbia University for electric resistance, etc.

See also Aluminum Aloys; Bearing Metals; Magnesium Alloys.

ALUMINUM

Industrial Applications. New Industrial Application of Aluminum, Magnesium, Calcium and Sodium. (Conférences et exposition publiques des nouvelles applications industrielles de l'aluminium du magnésium, du calcium et du sodium). Bul. de la Société d'Encouragement pour l'Industrie Nationale. vol. 133, no. 7, July-August-September, 1921, pp. 683-956, 186 figs., partly on supp. plates. Papers read at recent Aluminum Exposition, discussing manufacture, properties, alloys, castings, use in electric and food industries, welding, enameling, etc. See also Revue de Métallurgie, vol. 18, no. 9, Sept. 1921, pp. 541-607, 43 figs.

ALUMINUM ALLOYS

Bronzes. On the Heat-Treatment of Aluminum Bronze, A. A. Blue. Chem. & Met. Eng., vol. 25, no. 23, Dec. 7, 1921, pp. 1043-1048, 25 figs. Concludes from experiments that heat treatment produces marked and consistent changes in Brinell and scleroscope hardness and has little or no effect on tensile strength and yield point.

Researches. Researches on Aluminum Alloys, Walter Rosenhain, Sydney L. Archbutt and D. Hanson. Engineering vol. 112, nos. 2913 and 2914, Oct. 28 and Nov. 4, 1921, pp 614-615 and 644-645, also Engineer, vol 132, nos. 3436, Oct. 28, and Nov. 4, 1921, pp. 461-463 and 489-490. Brief account of principal contents of report to Alloys Research Committee. Deals with east and wrought alloys; permanence and constitution of alloys.

AMMONIA

Synthesis. The Procedure of the Synthesis of Ammonia, Carl Bosch. Chem. Age (N.Y.), vol. 29, no. 11, Nov. 1921, pp. 451-458, 5 figs. Process and apparatus for synthetic production of ammonia from nitrogen and hydrogen.

APPRENTICES, TRAINING OF

Shipyards. American Shipyard Apprenticeships, Evening Schools and Scholarships, Charles F. Bailey. Advance Copy, Soc. of Naval Architects & Mar. Engrs., meeting Nov. 17-18, 1921, no. 8, 10 pp., 1 fig. Reviews present situation, including requirements for apprenticeship. pay, bonus, evening schools, scholarships, etc., and makes suggestions for improvement.

AQUEDUCTS

Montreal, Can. History of the Montreal Aqueduct, A E. Doucet. Jl. Eng. Inst. Can., vol. 4, no. 12, Dec. 1921, pp. 601-605. Early methods of supply. Description of original aqueduct and first and second enlargements.

ARMATURES

Locating Faults in D.C. Locating Faults in Direct-Current Armatures — Effects of Grounds, B. A. Briggs. Power, vol. 54, no. 24, Dec. 13, 1921, pp. 927-929, 6 figs Discusses various conditions under which grounds may occur in an armature. Causes of insulation failure to ground. Testing for grounded coils with a lamp and how to cut these coils out of circuit.

AUTOMOBILE ENGINES

Anti-Freezing Solutions. Anti-Freezing Solutions, O. B. Zimmerman. Jl. Soc. Automotive Engrs., vol. 9, no. 5, Nov. 1921, pp. 307-310 and (discussion) 310-312. Progress report of Committee of S.A.E., discussing cooling media and their ideal requirements.

[illegible] Camshafts. Machinery (Lond.), vol. 19, no. 477, Nov. 17, 1921, pp. 189-194, 9 figs. Description of important oper[illegible] manufacturing procedure in making camshafts for a high-grade motor-car.

[illegible]

[illegible] J. William Chubb. Am. Mach., vol. 55, no 21 Nov. 24, 1921, pp. 827-830, 10 figs. Methods used in well-equipped English motor plant. Cylinders produced on American [illegible]

AUTOMOBILE FUELS

Air-Fuel Mixtures. Condensation Temperatures of Gasoline and Kerosene-Air Mixtures, Robert E. Wilson, and Daniel P. Barnard. Jl. Soc. Automotive Engrs., vol. 9, no. 5, Nov. 1921, pp. 313-319, 11 figs. Describes simple and reliable method for determining temperatures of initial condensation of fuels from air-fuel mixtures, and an approximate method of determining temperatures of partial condensation in such mixtures. From paper read before Am. Chem. Soc.

Benzol. *See Benzol.*

AUTOMOBILES

Brakes, Four-Wheel. The History of Four-Wheel Brakes. Autocar, vol. 47, no. 1361, Nov. 19, 1921, pp. 1057-1064, 21 figs. A series of articles on brakes, including, operating front wheel brakes, Servo brakes, and four-wheel brake tests.

Design. Car Design and Production. Autocar, vol. 47, no. 1362 Nove, 26, 1921, pp. 1123-1126, 7 figs. Shows how design, workshop processs and material costs influence selling price of a motor vehicle.

Frame Stresses. Automobile Frame Stresses, Ethelbert Favary. Jl. Soc. Automotive Engrs., vol. 9, no. 5, Nov. 1921, pp. 301-303 and (discussion) 303-306, 3 figs. Gives frame-stress calculations intended to enable the designer to proportion frames and parts with the view of eliminating some of the factors that are productive of excessive weight which causes fuel wastage. Laboratory tests of tensile strength, elastic limit, yield point, etc., of materials.

German 1921 Show. The German Automobile Exhibition 1921, A. Heller. Eng. Progress, vol 2, no. 11, Nov. 1921, pp. 241-246, 9 figs. Discusses motors, carburetors, radiators, electric equipment, head lights, speed change gear, back-axle drive, road wheels and springs.

Machining Differential Gear Case. Mtehods and Tools Used in Machining the Peerless Differential Carrier and Gear Case, Fred H. Colvin. Am. Mach., vol. 55, no. 23, Dec. 8, 1921, pp. 912-914, 11 figs. Turret lathe tooling for special jobs; drilling fixture for rapid handling of work; gages for surfaces which are not easy of access.

Mechanical Features. Progress in Design. Autocar, vol. 47, no. 1360, Nov. 12, 1921, pp. 945-953, 21 figs. Notes on engine design, gas passages, valves, lubrication, carburation, transmission, brakes, steering suspension, and wheels.

Repair Service. Automotive Service Methods and Equipment, Howard Campbell. Am. Mach., vol. 55, no. 22, Dec. 1, 1921, pp. 870-873, 7 figs. Details of service plant of Hellman Motor Corp., Long Island City, N.Y.

AVIATION

Commerciale. Commercial Aviation in France. (L'Aviation Commerciale Française), L. Hirschauer. La Technique Moderne, vol. 13, no. 4, April 1921, pp 145-153, 12 figs. Gives tabulation of lines in existence; shows development of aerial transport companies. their flying machines and government action; reviews activity in other countries.

B

BALANCING

Reciprocating Masses. The Exponential Method in the Analysis of the Balance of Reciprocating Masses, P. Cormack. Engineering, vol. 112, no. 2919, Dec. 9, 1921, pp. 778-780, 1 fig. Calculation of inertia forces for radial and rotating cylinder engines.

Rotating Parts. Balancing Rotating Parts. (Sur l'équilibrage des pièces en rotation). P. Lemaire. La Technique Moderne, vol. 13, no. 6, June 1921, pp. 249-257, 27 figs. Discusses static and dynamic balancing of machinery.

BEAMS

Irregularly Distributed Loads. Beams with Loads irregularly Distributed, T. Thompson. Engineering, vol. 112, nos. 2915 and 2916, Nov. 11 and 18, 1921, pp. 656-658 and 686-689, 7 figs. Describes method for speedy and accurate calculation of bending moments and deflections of beam with irregularly distributed loading.

BEARING METALS

Babbitt. Characteristics of Bearing Metals, Edward T. Keenan. Power, vol. 54, no. 25, Dec. 20, 1921, pp. 977-978. Composition of various babbitt metals for various kinds of bearings. List of babbitts and their compounds.

Industrial Value. Bearing Metals and Their Industrial Value, J. Czochralski. Brass World, vol. 17, nos. 9 and 10, Sept. and Oct, 1921, pp. 245-248 and 281-286, 33 figs. Sept: Discusses alloys in which tin is replaced by lead, and experiments carried out for the purpose. Oct: Methods of testing and comparative efficiency of bearing metals. Abstract). Zeit. F. Metallkunde.

BEARINGS

Hand vs. Machine-Finished. Hand Versus Machine Finished Bearings, E. A. Dixie. Am. Mach., vol. 55, no. 22, Dec. 1, 1921, pp. 888-890. Comparison of machine and hand-finished surfaces. Some examples of better and quicker work.

BEARINGS, BALL

Friction and Safe Load. Friction and Carrying Capacity of Ball and Roller Bearings, H. L. Whittemore and S. N. Petrenko. U.S. Bur. Standards Technologic Papers, no. 201, Oct. 6, 1921, 34 pp., 30 figs. Account of experiments undertaken to deternine maximum safe load and static friction under load of ball and flexible roller bearings. Results agree roughly with Herts's theory, differences being ascribable to inhomogeneity of material.

GRINDERS. Use of Ball Bearings as Adapted to Grinders, Donald A. Hampson. Can. Machy., vol. 26, no. 17, Oct. 27, 1921, pp. 30-32 and 36, 9 figs. Discusses advantages as to lower cost of production, increased output, higher efficiency, saving of power, etc.

BEARINGS, ROLLER

CALCULATION. Practical Calculations of Roller Bearings (Calcul pratique des roulements à rouleaux), P. Masson. La Technique Moderne, vol. 13, no. 5, May 1921, pp. 193-197, 3 figs. Discusses cylindrical and conical roller bearings and works out formulas. Comparison with ball bearings.

TYPES. Usual Forms of Roller Bearings (Les formes usuelles des roulements à rouleaux). La Technique Moderne, vol. 13, no. 6, June 1921, pp. 258-263, 22 figs. Describes products of various American, British, French and Swedish firms.

BLAST-FURNACE GAS

BURNING UNDER BOILERS. Burning Blast-Furnace Gas Under Boilers, Gordon Fox and F. H. Wilcox. Power, vol. 54, no. 24, Dec. 13, 1921, pp. 930-931. Discusses gas burner, ignition, combustion chamber, baffling, and draft losses through boiler passes.

BLIND

MPLOYMENT OF. The Employment of the Blind in Workshops. Engineering, vol. 112, no. 2917, Nov. 25, 1921, pp. 715-717, 7 figs. Deals with experience gained in Germany in employment of blind on machine work, and machining operations performed by blind at the Siemens-Schuckert Works.

BLUEPRINTING

IGH-SPEED MACHINE. A High-Speed Blue Printing Machine. Engineer, vol. 132,, no. 3438, Nov. 18, 1921, p 345, 5 figs. Describes new photo-printing machine brought out by B. J. Hall & Co., Ltd., London.

BOAT LIFTS

0-FT. LIFT. Elevators for Raising Boats to Considerable Heights (Elevators di navi per grandi altezze de sollevamento). L'Industria, vol 35, no. 17, Sept. 15, 1921, pp 391-394, 5 figs. Describes installation designed by four German companies for raising boats 36 meters, which works successfully.

BOILER FEEDWATER

TREATMENT. Boiler Feed Water Treatment and Treatment Control, E. C. Bashore. Power Plant Eng., vol. 25, no. 21, Nov. 1, 1921, pp. 1050-1052. Causes of scale, corrosion, foaming, embrittlement, and methods of treatment. (abstract). Paper read at Nat. Exposition of Chem. Industries.

The interior Treatment of Boiler Waters, C. R. Knowles. Ry. Age, vol. 71, no. 20. Nov. 12, 1921, pp. 935-936. Discusses introduction of substances into boiler to prevent scale, corrosion, foaming or other ill effects of bad water.

The Treatment of Boiler Feed Water, Robert June, Power House, vol. 14, no. 21, Nov. 5, 1921, pp. 21-23, 3 figs. Discusses artificial zeolite systems and evaporating methods.

BOILER OPERATION

L CONSUMPTION, CONTROL OF. The Influence of Weather on Coal Consumption, Malcolm C. W. Tomlinson. Management Eng., vol. 1, no. 6, Dec. 1921, pp. 321-326, 13 figs. Describes method of using outside temperature to check boiler operation.

BOILER PLANTS

ONOMICAL DESIGN. Boiler and Furnace Economy, D. S. Jacobus. Mech. Eng., vol. 43, no. 12, Dec. 1921, pp. 779-782. Deals with such questions as when it will pay to use economizers in a new plant; most economical rating at which to operate a boiler; limitations imposed on efficiency by inability of furnace brickwork to withstand temperatures available with many classes of fuel; furnace volume and length of flame travel; use of air heaters, etc.

Boiler-House Management, David Brownlie, Iron & Coal Trades Rev., vol., 103, nos. 2803 and 2804, Nov. 18 and 25, 1921, pp. 721-722 and 700-702. Nov. 18: Discusses efficient design and equipment of boiler plant and scientific control of the working of the plant. Types of boilers and relatives advantages and disadvantages. Nov. 25: Discusses mechanical stoking, economizers and feedwater heaters, superheaters, forced or induced draft, and auxiliary machinery. (Abstract). Paper read before South Wales Inst. Engrs.

BOILERS

EHEATING WITH FLUE GAS. Utilizing Flue Gases to Preheat Air to Furnace—Consideration of Some of the Problems Involved, E. R. Welles and C. T. Mitchell. Power, vol. 54, no. 22, Nov. 29, 1921, pp. 844-846, 1 fig. Points out that rough calculations (the best that can be made with available data) indicate reasonable possibility of economic application of preheating.

WATER WORKS. Selecting Steam Boilers for Water Works, F. W. Dean. Fire & Water Eng., vol. 70, nos. 22 and 23, Nov. 30 and Dec. 7, 1921, pp. 1007-1008, 1014 and 1027-1029 and 1053-1054 and 1058. Importance of choosing most economical type. Various kinds of boilers with their characteristics considered. Proper setting and fuel to be used. Boiler safety. (Abstract). Paper read before N. E. Water Works Assn.

BRAKES

MBINATION AIR AND VACUUM. Brakes on the Paulista Railroad (Frenos para el Ferrocarril Paulista), F. H. Parke. Ingenieria Intercolonial, vol. 6, no. 6, Dec. 1921, pp. 348-351, 3 figs. A combination of air and vacuum brake for electric locomotives drawing trains provided with air brakes, constructed by Westinghouse Air Brake Co.

WESTINGHOUSE DOUBLE-CAPACITY. Exceptional Train Loading in the United States and the Westinghouse Double Capacity Brake. Ry Gaz., vol. 35, no. 21, Nov. 18, 1921, pp. 769-771, 5 figs. Tests with 75,100 and 110-car coal trains, respectively 12,000, 16,000 and 17,250 American tons, on Virginian railway, fitted with Westinghouse empty and load brake.

BRASS

HEAT TREATMENT. Heat Treatment of Brass and Brasses Containing Tin, Léon Guillet. Chem. & Met. Eng., vol. 25, no. 22, Nov 30, 1921, pp 1009-1014, 16 figs. Brasses containing a little beta respend to heat treatment; tin-brasses, developing special constituent analogous to delta in bronzes, may have their physical properties changed very notably by proper annealing and quenching. From Revue de Métallurgie, July 1921.

HOT-WORKING. Hot Working of Brass (Le travail du laiton à chaud), A. Devilliers. La Technique Moderne, vol 13, no 5, May 1921, pp 206-209, 8 figs. Discusses [illegible] content of lead, effect of aluminum and pros and cons of hot and cold working.

BRIDGE DESIGN

LONG SPAN. Some Thoughts on Long-Span Bridge Design, Gustav Lindenthal. Eng., News-Rec., vol 87, no. 21, Nov. 24, 1921, pp. 861-864. Notes on architectural features; aesthetics and East River bridges; wire-cable problems and eyebar chain possibilities.

BRIDGES, RAILWAY

STRESS CALCULATION. The Influence of Rigid Connections on the Distribution of Live Loads on Raileay Underbridges, Conrad Gribble. Ry. Engr, vol. 42, no. 502, Nov. 1921, pp. 413-417,12 figs. Shows that not only bending moments but shears and reactions are different from those which would be deduced from the assumption of free ends.

C

CALORIMETERS

RECORDING. Report on Recording Calorimeters, Gas World, vol. 75, no. 1943, Oct. 15, 1921, pp. 314-319 and (discussion) 319-321, 5 figs. Fifth report of Research Sub-Committee of Gas Investigation Committee giving results of tests made.

CARBURETORS

AIRCRAFT. Instructions to Designers of Aircraft Carburetors. Air Service Information Circular, vol 3, no. 291, Oct. 20, 1921, 4 pp. 2 figs. Deals with general requirements of carburetor design, gasoline inlet connection, gasoline strainer, float chamber, metering jets, air intake pipe, venturis, throttles, mixture control. performance, tests inspection, etc.

KEROSENE CARBURETION. Actual State of Kerosene Carburetion (Etat actuel de la carburation au pétrole lampant), Sigma. La Métallurgie, vol. 53, no. 45, Nov. 10, 1921, pp. 2101-2102. Discusses mixing, ignition, combustion, flame control, etc. (Concluded)

METERING CHARACTERISTICS. Report on the Control of Carburetor Metering Characteristics by the Supplementary Admission of Air. Air Service Information Circular, vol. 3, no. 292, Oct 20, 1921, 14 pp., 9 figs. Results of test to determine characteristics of mixture-control device operating on principle of supplementary admission of air, particularly as applied to high-compression, over-dimensioned aviation engine, under laboratory and flight conflictions.

TESTING ZENITH. Testing a Zenith Carburetor (Essai d'un carburateur Zénith à triple diffuseur sur voiture 16 hp. Panhard S.S.), Henri Petit. La Vie Automobile, vol. 17, no. 739, Oct. 10, 1921, pp. 374-375, 2 figs. Details of three tests on a 16-hp. Panhard.

CARS

ELECTRIC. Illinois Central Steel Suburban Coaches. Ry. Mech. Engr., vol. 95, no. 12, Dec. 1921, pp. 755-759, 11 figs. Designed for future electrification; doors electrically controlled; total weight 92,100 lbs.

CARS, COAL

STEEL HOPPER. All-Steel Coal Hopper Wagons for Bengal-Nagpur Railway. Ry. Engr., vol. 42, no. 502, Nov. 1921, pp. 405-409, 5 figs. High-capacity hopper wagons constructed by Midland Railway Carriage & Wagon Co., Ltd., Birmingham, for Bengal-Nagpur Railway, to the design of J. W. Barry.

CARS, FREIGHT

BOX. The Use of Ordinary Box Cars for Shipping Fruit, Vane G. Gibson and Herbert Graff. Ry. Rev., vol. 69, no. 20, Nov. 12, 1921, pp. 643-646, 7 figs. Tests undertaken by Department of Agriculture show most practical means for ventilating box cars. (Abstract).

CONTAINER. Avoidable Waste in Car Operation—The Container Car, Walter C. Sanders. Mech. Eng., vol. 43, no. 12, Dec. 1921, pp. 799-802, 9 figs. Describes "container" cars recently placed in service on N.Y. Central lines and others having improvements on original type which are now under construction. Advantages of described car are enumerated.

WOOD IN CONSTRUCTION OF. The Use of Wood in Freight Car Construction, H. S. Sackett. Ry. Age, vol. 71, no. 22, Nov. 26, 1921, pp. 1037-1042, 6 figs. Relative advantages of double and single sheathed box car; composite gondola car; advantages of composite design; etc. Gives table of lumber grades and dimensions.

CARS, PASSENGER

ALL-STEEL. Illinois Central Suburban Operation and Equipment. Ry. Rev., vol. 69, no. 21, Nov. 19, 1921, pp. 669-677, 14 figs. Describes new all-steel cars just put in service as first step toward electrification.

New All-Steel Suburban Coaches for the South African Railways. Ry. Gaz., vol. 35, no. 20, Nov. 11, 1921, pp. 722-725, 6 figs. Describes all-steel composite bogie coaches built by Leeds Forge Co., Ltd., constructed on central gangway principle.

DESIGN. On the Question of Passenger Carriages, W. J. Tollerton. Bul. Int. Ry. Assn., vol. 3, no 10, Oct. 1921, pp 1399-1440, 52 figs. Gives list of questions and answers regarding general types and arrangements of passenger carriages used in U. S., Canada and Mexico, details of construction of principal parts of carriage, lighting, heating, ventilating, etc.

CARS, TANK

MILK. Handling Milk in Specially Constructed Tank Cars. Ry. Mech. Engr., vol. 95, no. 12, Dec. 1921, pp. 763-764, 3 figs. Large glass-lined steel tanks save expense in handling and haulage; refrigeration in transit eliminated.

CAST IRON

SELF-CORROSION. Self-Corrosion of Cast Iron and Other Metals in Alkaline Soils, W. Nelson Smith and J. W. Shipley. Elec. Ry. Jl., vol. 58, no. 21, Nov. 19, 1921, pp. 911-912. Results of investigation to show that city water main external corrosion could not be due to electrolysis from stray currents. (Abstract). Paper read before Eng. Inst. of Can.

CENTRAL STATIONS

AUXILIARY DRIVES. Relation of Auxiliary Drives to Heat Balance, J. R. McDermet. Power, vol. 54, no. 23, Dec. 6, 1921, pp. 888-890, 1 fig. Deals with direct steam drive, motor drive, house turbines, combination drives, and feedwater heating by bleeder condensers.

SUPERPOWER. A Superpower System for the Region Between Boston and Washington, W. S. Murray. U. S. Geol. Surv' professional paper 123, 1921, 261 pp., 61 figs. and 11 supp. plates. Market for superpower energy will be furnished by electric utilities, industries, and railroads. Estimated requirement for energy supplied through electric utilities for municipal, private, industrial, and railroad purposes in 1930 is 31,000,000,000 kw-hr., which could be supplied by co-ordinated power system such as is described. Study of 96,000 manufacturing establishments operating within superpower zone shows that by 1930, they can save $190,000,000 annually above fixed annual charge sagainst capital investment of $185,000,000. See a so Power Plant Eng. vol. 25, no. 24, Dec. 15, 1921, pp. 1185-1187, 1 fig.

CHARTS

SCALE SELECTION. Scale Selection for Z Charts, Arthur R. Burnet. Management Eng., vol. 1, no. 6, Dec. 1921, pp. 365-370, 4 figs. Describes new method of chart making and curve plotting and compares it with older method.

CHIMNEYS

TALL, DESIGN OF. Notes on the Design of Tall Chimneys and Their Foundations, J. M. Wade. Roy. Engrs. Jl., vol. 34, no. 5, Nov. 1921, pp 209-219, 6 figs. Discusses design, height, draft, and calculations, including calculations of gases formed by combustion of one ton of coal, and for height and outlet of a chimney for furnaces consuming two tons of fuel per hour.

CHROME STEEL

AUTOMOBILE INDUSTRY. Chromium Steels and Irons Leslie Aitchison. Iron & Coal Trades Rev., vol 103, no. 2802, Nov. 11, 1921, pp. 686-687 Discusses alloy and carbon steels, effect of alloying on critical temperature, mechanical properties, stainless steels, and vanadium additions, especially in connection with the automobile industry.

MECHANICAL PROPERTIES. Chromium Steels and Iron, Leslie Aitchison. Engineering, vol. 112, nos. 2918 and 2919 Dec. 2 and 9, 1921, pp. 771-772 and 805-807, 5 figs. Brief account of general effect which chromium exerts upon steels, followed by description of mechanical properties of chrome steels. Paper read before Instn. Automobile Engrs.

COAL

BRIQUETTING. Duplex Coal-Briquetting Machine. Engineering, vol 112, no. 2916, Nov. 18, 1921, pp. 689-691, 12 figs. Describes machines constructed by Sutcliffe, Speakman & Co., Ltd., Leigh, England, weighing 32 tons and exerting pressure of 200 tons on material. At speed of 30 working strokes per min. machine turns out 40 tons of briquettes per hr. with expenditure of 48 hp.

COKE OVENS

SILICA BRICK FOR. Silica Brick For Coke Ovens, A. H. Middleton. Colliery Guardian, vol. 122, no. 3174, Oct. 28, 1921, pp. 1203-1204. Discusses advantages of silica over quartzite brick, including greater output and thermal efficiency, greater durability, resistance to corrosion, etc. Author would not advise use of brick with higher specific gravity than 2.35 for very high temperatures. Paper read before Coke Oven Managers' Assn. Report of discussion on above paper in Colliery Guardian, vol. 122, no. 3175, Nov. 4, 1921, [illegible] 1274

COLUMNS

BUCKLING UNDER AXIAL LOAD. Buckling of Elastic Structures, H. M. Westergaard. Proc. Am. Soc. Civ. Engrs. vol. 47, no. 9, Nov. 1921, pp. 455-533, 14 figs. Investigation deals with structural actions in which stresses are not proportional to loads, although proportional limit of material has not been exceeded and deflections remain small. Describes astatic and in particular, heterostatic action. Deals also with columns carrying axial and transverse loads at same time. Formulas are given for buckling of slabs and systems of crossing-beams. Classified bibigroaphy.

COMBUSTION

CONTROLLING RATE. Controlling the Rate of Combustion. Sanitary and Heating Eng., vol. 96, no. 11, Nov. 18, 1921, pp. 313-314, 2 figs. Discusses hydraulically operated damper regulators in low pressure heating plants.

COMPRESSED AIR

INTERCOOLING. Value of Intercooling Compressed Air, C. K. Bennet. Power Plant Eng., vol. 25, no. 23, Dec. 1, 1921, pp. 1142-1144, 5 figs. Methods and means of cooling air during and after compression.

CONCRETE

AGGREGATE, SAND IN COARSE. Permissible Tolerance of Sand in Coarse Aggregates W. K. Hatt. Pub. Roads, vol. 4, no. 6, Oct. 1921, pp. 19-21 and 26, 8 figs Results of investigation of 1:2:3. 1:2:4 and 1:3:6 concrete, using in each case both a fine and coarse sand as fine aggregate.

PROPORTIONING. Method of Proportioning Concrete Materials—Screened and Unscreened Gravel, R. W. Crum. Iowa State College of Agriculture & Mechanic Arts Official Publication, vol. 19, no. 51, May 18, 1921, bul. 60, 56 pp., 21 figs. Based on laboratory investigations carried out by P. J. Preston Describes laboratory tests made in verification of method.

CONCRETE CONSTRUCTION, REINFORCED

SEA WATER, IN OR NEAR. Use of Reinforced Concrete in or Near Sea Water. Eng & Contracting vol 56, no. 21, Nov. 23, 1921, pp. 487-488. Report submitted by Arthur S. Tuttle of Board of Estimates & Apportionment of New York City. Summary of rules for securing durable work.

CONCRETING

FREEZING WEATHER, IN. The Cooling of Fresh Concrete in Freezing Weather, Tokujiro Yoshida. Eng. & Contracting, vol 56, no. 21 Nov. 23, 1921, pp. 474-478, 7 figs. Data on length of time required for concrete of given temperature to lose its heat and become cold enough to freeze when exposed to temperatures lower than freezing point of water. (Abstract). Bulletin issued by Engineering Experiment Station of University of Ill.

CONDENSERS, STEAM

COOLING-WATER TREATMENT. Chemical Treatment of Water for Cooling Condensers (Du traitement chimique des eaux servant à la réfrigération des condenseurs), G. Paris. Chaleur et Industrie, vol. 2, no. 18, Oct. 1921, pp. 634-642, 12 figs. Describes Balke process which changes bicarbonate of lime and magnesium into chlorides by addition of hydrochloric acid, and the Hulsmeyer process depending on thermic action and addition of sodium carbonate.

CONVEYORS

MOLD. Conveyor System Cuts Moulding Costs, Herbert H. Leonard. Can. Manufacturer, vol. 41, no. 11, Nov. 1921, pp. 31-35, 11 figs. Moulding car wheels on jolt machines is made possible by adoption of conveyor systems for transferring molds, flasks and sand, supplemented by I-beam trolleys and gravity conveyors

NEW SYSTEM. Tramrail Reduces Labour Force to Half. Iron Age, vol. 108, no. 24, Dec. 15, 1921, pp. 1523-1525, 3 figs. States that marked reduction in production costs has been effected by Globe Machine & Stamping Co., Cleveland, by installation of new conveying system and japanning equipment.

COPPER METALLURGY

SULPHATE, MANUFACTURE OF. The Manufacture of Copper Sulphate, H. Suchanek. Chem. Trade Jl. & Chem. Engr., vol. 69, no. 1801, Nov. 26, 1921, pp. 652-655. Principal materials for preparation of copper sulphate are old copper, copper-containing residues, ashes, etc. cupreous pyrites, ores poor in copper, and impure sulphate solutions. Description of plant for use of scrap copper as raw material; and manufacture from other cupreous materials. Translated from Chemiker-Zeitung, Nov. 3, 1921.

COST ACCOUNTING

JOB CARDS. Job Cards, Hubert Bentley. Eng. & Indus. Management, vol. 6, no. 19, Nov. 10, 1921, pp. 533-534, 2 figs. Outlines useful method of keeping distinct record of time taken on jobs for costing purposes. Describes specimen job cards

COST SYSTEMS

FOUNDRY. Advantages of a Foundry Cost System, Robert E. Belt. Iron Age, vol. 108, no. 21, Nov. 24, 1921, pp. 1351-1353. Points out that it forms basis for establishing selling price and indicates degree of efficiency of various departments. Paper read before Nat. Founders' Assn.

CRANES

Metallurgical Industry. Modern Cranes and Conveyors in the Metallurgical Industry (Les appareils modernes de levage et de manutention dans l'industrie metallurgique), Lucien Dujardin. L'Outillage, vol. [illegible], no. 12, Oct. 20, 1921, pp. 1087-1103, 50 figs. A number of articles discussing construction and operation of apparatus for charging furnaces of various systems, electromagnets, crane trucks, etc.

Mounted on Trucks. The Truck with the Giant Arm. Commercial Vehicle, vol. 25, no. 8, Nov. 1921, pp. 30-31, 4 figs. Universal crane, mounted on different trucks, speeds up all types of loading and gives greater flexibility in maneuvring into position.

CRANKSHAFTS

Grinding. Crankshaft Grinding. Eng. Production, vol. 3, no. 58, Nov. 10, 1921, pp. 447-450, 11 figs. Notes on special machines and attachments.

CUTTING METALS

Acetylene Jet-Cutting Machines. Economy in Metal Cutting. Eng. & Indus. Management, vol. 6, no. 20, Nov. 17, 1921, pp. 565-566, 2 figs. Describes Godfrey acetylene jet-cutting machine and its economic advantages.

Oxy-Hydrogen Cutting. Effect of Oxy-Hydrogen Cutting on Locomotive Rods, Arthur F. Pitkin, Am. Mach., vol. 55, no. 24, Dec. 15, 1921, pp. 964-965, 11 figs. Unusual examples of rapid cutting together with data as to its effect on steel used in locomotive rods.

D

DAMS

Earth. Reclamation Service Building Highest Earth Dam, R. T. Crowe, Eng. News-Rec., vol. 87, no. 22, Dec. 1, 1921, pp. 890-891, 4 figs. Tieton dam to be 232 ft., high with concrete core wall 100 ft into rock. Unique method of building corewall. Reprinted from Reclamation Rec., Oct.

Multiple-Arch. Calculations of Multiple Arch Dams (Sul calcolo delle dighe ad archi multipli), Gregori Antonino. Giornale dell' Associazione Nazionale degli Ungegneri Italiani. vol. 2, no. 8, June 1, 1921, pp. 111-114, 2 figs. Deals with stresses and construction of arches.

DIE CASTINGS

Design and Use. Die Castings and Their Use in Industry, C. T. Roder. Iron Age, vol. 108, no. 22, Dec. 1, 1921, pp. 1409-1411. Their relation to consumers of sand or malleable castings. Dies and their construction. Designing of castings.

DIESEL ENGINES

Ansaldo-San Giorgio. 300-Hp. Two Cycle Diesel Engine. Engineering, vol. 112, no. 2917, Nov. 25, 1921, pp. 721-722, 10 figs, on supp. plate. Describes new series of engines built by Ansaldo-San Giorgio of Turin and Spezzia, Italy, intended primarily for industrial purposes. Results of tests with two-stroke, single-acting engine with three vertical cylinders.

Beardmore-Tosi. Trials of the Beardmore-Tosi Diesel Engine. Engineer, vol. 132 no. 3437, Nov. 11, 1921, pp. 508-510, 12 figs, one on p. 512. Results of trial are presented. Beardmore-Tosi engine, salient features of which are described, is said to mark distinct advance in four-cycle engine construction. See also Shipbldg. & Shipg. Rec., vol. 18, no. 19, Nov. 10, 1921, pp. 605-606, 3 figs. on pp. 600-601.

Compressorless. A Compressorless Diesel Engine. Power Plant Eng., vol. 25, no. 23, Dec. 1, 1921, pp. 1146-1147, 2 figs. Fuel injected without air, under pump pressure; gradual combustion at constant pressure; air compressed by lower end of piston; crosshead to take connecting-rod thrust.

Electricity Supply and. The Function of the Heavy Oil Engine in Connection with the General Supply of Electricity, Geoffrey Porter. Gas & Oil Power, vol. 17, no. 194, Nov. 3, 1921, pp. 22-24, 2 figs. Discusses oil fuels, Diesel engine, design, especially the Still Engine and advantages of heavy oil engines based on comparative figures From paper read before Diesel Engine Users' Assn.

Sulzer. The New Sulzer Diesel Engine, A. P. Chalkley. Mar. Eng., vol. 26, no. 11, Nov. 1921, pp. 845-846, 2 figs. Describes new Sulzer marine Diesel engine with turbo-scavenging; 1,350 b. hp. at 95 r.p.m.; built by Winterthur Works and being installed in a 9,000-ton deadweight motorship.

DISABLED MEN

Training of. On Behalf of the Industrial Disabled, Gerald A. Boate. Indus. Management, vol. 62, no. 6, Dec. 1921, pp. 345-352, 2 figs. Includes alphabetical list of occupations in which disabled men have been retrained. Scientific selection of suitable occupations for disabled men.

DRAWINGS

Production and. Drawings and Production. Eng. Production, vol. 3, no. 62, Dec. 8, 1921, pp. 533-536. Discussion of Albert F. Guyler's paper with above title read before Instn. Production Engrs.

Suggestions for Making. Drawings and Production, Albert F. Guyler. Eng. Production, vol. 3, no. 61, Dec. 1, 1921, pp. 509-513, 13 figs. Suggestions for the making of drawings. Paper presented before Instn. Production Engrs.

DRILLING MACHINES

Recent Developments. Recent Machine-Tool Developments—XXIII, Joseph Horner, Engineering, vol. 112, no. 2919, Dec. 9, 1921, pp. 780-783, 11 figs. Deals with different types of drilling machines.

DROP FORGING

Modern Practice. Modern Drop-forging Practice, Fred. R. Daniels. Machy. (N.Y.), vol. 28, no. 4, Dec. 1921, pp. 308-312, 7 figs. Notes on trimming forgings; forging heats. Typical examples of drop-forging work.

E

ECONOMIZERS

Feedwater Heaters and. The Selection of Economizers and Feed-Water for Municipal Power-Plants, W. F. Schaphorst. Am. City, vol. 25, no. 6, Dec. 1921, pp. [illegible], 4 figs. Discusses operation of economizers and two types of feedwater heaters.

EDUCATION, ENGINEERING

Early Training. The Education of Engineers, E. A. Allcut. Eng. & Indus. Management, vol. 6, no. 22, Dec. 1, 1921, pp. 633-637. Refers to lack of coordination in connection with early training of engineers and points out discrepancies (starting at elementary schools) with view to their ultimate disappearance or modification.

ELECTRIC COOKING

Dining Car. The Great Northern's New Restaurant Train. Ry. Gaz., vol. 35, no. 19, Nov. 4, 1921, pp. 694-695, 4 figs. Further details of electric cooking equipment.

ELECTRIC FURNACES

Melting and Refining. The Electric Furnace in Melting and Refining, John B. C. Kershaw. Electrician, vol. 87, no. 2270, Nov. 18, 1921, pp. 636-639, 5 figs. Annual review of developments, including modern tendencies in electric-furnace design, the Soderberg electrode, and the Russ electric arc furnace.

Resistance. New Electric Resistance Furnaces for Heat Treating Steel (Nouveaux fours électriques à résistance pour le traitement thermique de l'acier). L'Industrie Electrique. vol. 30, no. 705, Nov. 10, 1921, pp. 405-407, 4 figs. Describes vertical furnace and horizontal continuous furnace developed during war.

Smelting. Smelting Iron Ore Electrically, Frank Hodson. Iron Trade Rev., vol. 69, no. 23, Dec. 8, 1921, pp. 1492-1493. Points out that inexperience and inadequate financing have been responsible for failure of many efforts to place direct processes of steelmaking on practical basis.

ELECTRIC LAMPS, INCANDESCENT

Performance Equations. Simple Equations for the Lamp Performance, H. E. Eisenmenger. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 12, Dec. 1921, pp. 905-912, 7 figs. Author seeks to find new empirical equations for relations between "fundamental quantities" of incandescent lamps (voltage efficiency, candle power. life wattage, current, and resistance). Gives number of new equations for voltage-candle power relations, some of which are so simple that they do not require evolution.

ELECTRIC LOCOMOTIVES

Design. Selecting Designs for Electric Locomotives, A. W. Gibbs. Ry. Age, vol. 71, nos. 21 and 22, Nov. 19 and 26, 1921, pp. 987-989, 4 figs, and pp. 1057-1060, 15 figs. Nov. 19: Describes methods used for testing locomotive and discusses electric locomotive drives. Nov. 26: Tests indicate that non-symmetrical wheel arrangement is essential for best performance. (Abstract). Paper read before Franklin Inst.

Storage-Battery. Storage-Battery Locomotives in Metal Mines, E. V. Daveler and R. E. Renz. Min. & Sci. Press, vol. 123, no. 22, Nov. 26, 1921, pp. 751-752. Describes experience in Butte & Superior mine; provisions for safety; care and service of locomotives. Paper read before Nat. Society Congress.

ELECTRIC MOTORS

Control Equipment for Auxiliary. Control Equipments for Auxiliary Motors, M. D. Wright. Assn. Iron & Steel Elec. Engrs., vol. 3, no. 11, Nov. 1921, pp. 493-506 and (discussion) 507-521, 11 figs. Discusses motor control for steel mill drives, automatic acceleration, voltage drop relays, shunt contactors, etc.

ELECTRIC MOTORS, A.C.

Phase Advancers with Induction. The Oscillating Phase Advancer, W. E. Milton Ayres. English Elec. Jl., vol. 1, no. 7, July-October 1921, pp. 298-306, 9 figs. Discusses savings effected by use of phase advancers with induction motors, covering cost of motor, power factor, distributing system, substation transformers, etc.

ELECTRIC MOTORS, D.C.

Starting Panels. A Drum-Type Starting Panel for Electric Motors. Engineering, vol. 112, no. 2917, Nov. 25, 1921, pp. 726-728, 9 figs. Starter constructed by Brock, Hirst & Co., Ltd., embodies spring-controlled fingers which are self-aligning, and of which contact pressure may be individually adjusted, while drum is ground with copper segments in position so that latter from part of true cylinder and give even contact with fingers.

ELECTRIC RAILWAYS

CAR-YARD LAYOUT. Dead Mileage Saving to Pay for New Car Storage Facilities. Elec. Ry. Jl., vol. 58, no. 20, Nov. 12, 1921, pp. 852-853, 13 figs. Discusses flexible track layout and tipple for loadings and and coal at new car yard of Northern Ohio Traction & Light Co. in Akron.

SWITZERLAND. On the Question of Electric Traction, E. Huber. Bul. Int. Ry. Assn., vol. 3, no. 10, Oct. 1921, pp. 1357-1398, 2 figs. Gives history of single-phase traction in Switzerland and general tabular description of most important Swiss lines. Consumption of energy, load factor, maintenance cost of locomotives, and some results of trials. Bibliography.

ELECTRIC SWITCHES

PIPE FRAMEWORKS. Standard Pipe and Fittings for Outdoor Switching Frames, L. J. Moore. Elec. World, vol. 78, no. 21, Nov. 19, 1921, pp. 1020-1023, 3 figs. Found more convenient to keep in stock and transport; do not require special labor for assembly; can be quickly erected and stand service better than wood frames.

ELECTRIC WELDING

SCIENCE OF. The Science of Electric Welding, W. E. Ruder. Jl. Franklin Inst., vol. 192, no. 5, Nov. 1921, pp. 561-583, 24 figs. Notes on carbon electrode arc welding; metallic arc process; metallography of welds; metal transfer; electrodes; reliability of welded joints; electrical characteristics and equipment; automatic arc welding.

ELECTRON METAL

See Magnesium Alloys.

ELEVATED RAILWAYS

HAMBURG, GERMANY. Ten years of the Hamburg Elevated Railway, Wilhelm Mattersdorff. Elec. Ry. Jl., vol. 58, no. 23, Dec. 3, 1921, pp. 879-895, 16 figs. Describes improvements made in recent years and gives operating data.

ELEVATORS

INTERLOCKS, SURVEY OF. Results of a Survey of Elevator Interlocks and an Analysis of Elevator Accident Statistics, C. E. Oakes and J. A. Dickinson. U. S. Bur. Standards Technologic Papers, no. 202, Oct. 17, 1921, 30 pp. Gives results of field survey of several thousand elevator landings equipped with various types of mechanical and electromechanical interlocks and contact devices. Survey was conducted in connection with preparation of elevator safety code in cooperation with engineers of Am. Soc. Mech. Engrs. Statistics show that 73.8 per cent of all fatal accidents might be prevented by well-designed interlocks.

EMPLOYMENT

CONTINUOUS, PROBLEM OF. The Engineering Approach to the Problem of Continuous Employment, Richard A. Feiss. Bul. Taylor Soc., vol. 6, no. 5, Oct. 1921, pp. 187-194. Deals with problems and importance of stabilization of employment.

EMPLOYMENT MANAGEMENT

TRADE TESTS. The Value of the Trade Test in Industry, Russell J. Waldo. Management Eng., vol. 1, no. 6, Dec. 1921, pp. 351-357, 7 figs. Shows parts of typical trade tests used by writer with unusual success.

ENAMELING

INDUSTRIAL ENAMELED EQUIPMENT. Uses for Industrial Enameled Equipment, Max Donauer. Chem. & Met. Eng., vol. 25, no. 22, Nov. 30, 1921, pp. 1015-1020, 21 figs. Discusses advantages and properties of enameled equipment for various purposes, especially food industries. (Abstract) Paper read before Am. Ceramic Soc.

ENGINEERS

BUSINESS METHODS. Business Methods of European Engineers Compared with Those of American Engineers, Axel Malm. Jl. Engrs.' Club Phila., vol. 38-11, no. 203, Nov. 1921, pp. 389-391. Discusses salesmanship, advertising methods and [illegible] of foreign and American engineers.

ENGINEHOUSES

COLD-CLIMATE. Novel Engine Facilities for a Cold Climate, Ry. Age, vol. 71, no. 22, Nov. 26, 1921, pp. 1049-1051, 2 figs. Describes rectangular enginehouse containing turntable, at Hoornepayne, Ont., constructed by Can. Nat. Ry. Co.

F

FACTORY MANAGEMENT

[illegible]

FANS, CENTRIFUGAL

DESIGN. The Design and Construction of Fans—XIII and XIV, F. G. Whipp. Mech. World, vol. 70, [illegible] Nov. [illegible] and Dec. 2, 1921, pp. 370- [illegible] and calculations of area and pressure; gives table of losses due to friction, design and calculation.

FATIGUE

SAFETY WORK AND. Fatigue Study: A first Step in Safety Work, Frank B. and L. M. Gilbreth. Eng. & Indus. Management, vol. 6, no. 20, Nov. 17, 1921, pp. 557-558. Authors show how fatigue can prove most useful in safety work, and that same methods and devices at present employed in factories and offices can be used effectively to do both types of work.

FILTERS

CLEANING SEWAGE. The Maintenance of Clean Filtering Medium in Sewage Filters, Herbert D. Bell.Surveyor, vol. 60, nos. 1557 and 1558, Nov. 18 and 25, 1921, pp. 345-346 and 375-376, 1 fig. Deals principally with media in percolating filters. Experimental results. Paper read before Assn. Mgrs. Sewage Disposal Works.

FLOOD CONTROL

SAN ANTONIO FLOOD. The Flood of September 1921, at San Antonio, Texas. C. Terrell Bartlett. Proc. Am. Soc. Civ. Engrs., vol. 47, no. 9, Nov. 1921, pp. 443-454, 5 figs. Describes flood in detail and its engineering aspects, and outlines briefly principal geographic, topographic and clinatic features of region.

FLOW IN PIPES

HOT GASES. Flow of Hot Gases in Pipes (Expériences très simples au sujet des mouvèments des gaz chauds dans des tuyaux), J. Seigle. Revue de l'Industrie Minérale, no. 19, Oct. 1, 1921, pp. 607-611, 10 figs. Describes expirements in connection with circulation of hot gases and smoke in furnaces.

FLOW OF STEAM

NOZZLES. Note on the Flow of Air and Steam in Nozzles, Gerald Stoney and Norman Elce. Engineering, vol. 112, no. 2918, Dec. 2, 1921, pp. 750-751. Notes on discharge coefficients which afford evidence that no condensation takes place before throat with wet or saturated steam, and that saturated steam acts down to throat as a perfect gas with adiabatic index of 1.3.

FOREMEN

TRAINING OF. How to Educate Foremen, V. M. Palmer. Indus. Management, vol. 62, no. 6, Dec. 1921, pp. 321-324. Importance of giving them systematic training and method of accomplishing this.

FORGING

FLOW OF METAL. The Flow of Metal During Forging, Harold F. Massey. Mech World, vol. 70, nos. 1820, 1821, and 1822, Nov. 18, 25 and Dec. 2, 1921, pp. 408-410, 424-425 and 444-447, 33 figs. Results of a number of experiments, particularly to study the relation between the action of forging by pressure and by blows. Paper read before Manchester Assn. of Engrs.

FOUNDRIES

CHARGING PLATFORM. Charging Floor with Undercover Storage, Edwin A. Hunger. Iron Age, vol 108, no 23, Dec 8, 1921, pp 1459-1462 7 figs Details of new foundry and machine shop of Duplex Printing Press Co., Battle Creek Mich Notable feature is big charging platform entirely under cover, with storage capacity for 5,000 tons of metal and ten carloads of coke at one time Raw materials unloaded in single operations. Core-making expedited with special cement boxes.

CONVEYORS FOR. Decreasing Foundry Costs Through the Mechanical Handling of Materials, J. M. Macrae. Management Eng., vol. 1, no. 5, Nov. 1921, pp 257-259, 3 figs. Describes application of complete conveyor system installed in the Kelsey Wheel Co. foundry, Detroit, Mich.

MATERIAL-HANDLING EQUIPMENT. Solves Material Handling Problems in Design of New Foundry, H. R. Simonds. Iron Trade Rev., vol. 69, no. 24, Dec. 15, 1921, pp. 1545-1549, 10 figs. Electrically controlled cars for raw materials. storage-battery lift trucks for ladles and castings, and monorail system speed operations in new casting plant in Springfield, Mass. Molding floor routine is flexible. Wood block floor used in all operating departments.

SYSTEMATIZING PRODUCTION. Systematizing Foundry Production, Hubert Bentley. Eng. & Indus. Management, vol. 6, no. 22, Dec. 1, 1921, pp 631-632, 2 figs. Describes efficient system capable of general application in foundry Deals with regulation of supply of castings, method of ordering storage, and recording of work in hand.

FOUNDRY PRACTICE

METAL CASTING. Problems Involved in Casting Metal, Thomas Turner, Foundry vol. 49, no. 3, Dec. 1, 1921, pp. 926-933, 6 figs. With good foundry practice sound castings can be obtained from any metal provided there are no reactions which lead to formation and evolution of gas. (Abstract.) Paper read before Inst. of Metals.

FUELS

RESEARCH. Fuel Research Developments, C. F. Kettering. Jl. Soc. Automotive Engrs., vol. 9, no. 5, Nov 1921, pp 291-296 and 343-344, 15 figs. Discusses multi-cylinder distribution and chemical constitution of mixtures, anti-knock substances, ignition point, future fuel research, etc.

SAWDUST. Sawdust Burned with Aid of Steam Jets. Power, vol. 54, no. 24, Dec 13, 1921, pp 914-917, 3 figs Large industrial plant at Cleveland, Ohio, burns both sawdust and coal under same boilers. Automatic control speeds up stokers when sawdust supply becomes low.

Smokeless. Low Temperature Carbonisation. Eng. & Indus. Management, vol. 6, No. 16, Oct. 20, 1921, p. 445. Describes works erected by Low Temperature Carbonisation, Ltd., Barugh. [illegible] it is claimed, production of smokeless fuel, coalite, together with valuable by-products, is now a commercial proposition.
See also Pulverized Coal.

FURNACES, HEATING

Automatic Grates. Automatic Grates and Their Application in High Temperature Combustion Chambers (Les grilles automatiques dans leurs applications aux chambres de combustion à haute température), F. Verdeaux. La Technique Moderne, vol. 13, no. 10, Oct. 1921, pp. 414-417, 3 figs. Discusses heating furnaces in particular; relation between temperature at fire bridge and fuel consumption; [illegible]

FURNACES, HEAT-TREATING

Springs. Furnaces for Heat Treating Springs. Forging & Heat Treating, vol. 7, no. 11, Nov. 1921, pp. 568-572, 18 figs. Stationary and continuous furnaces; types and arrangement.

FURNACES, HOT-AIR

Testing. Air Management in Furnace Testing, A. C. Willard, A. P. Kratz and V. S. Day. Jl. Am. Soc. Heating & Ventilating Engrs., vol. 27, no. 8, Nov. 1921, pp. 797-812, 11 figs. Describes air-weighing plant for calibration purposes, and the Wahlen gage for measuring small air pressures.

FURNACES, REVERBERATORY

Side Charging. History of Side-Charging of Reverberatory Furnace. Eng. & Min. Jl., vol. 112, no. 22, Nov. 26, 1921, pp. 856-858. Gives summary of litterature on reverberatory smelting of copper ores, including Anaconda method, development of side feeding, fettling, etc., reviews patent situation involved.

FURNACES, ROASTING

Development, America. Evolution of Mechanical Roasting, Arthur S. Dwight. Min. & Metallurgy, no. 180, Dec. 1921, pp. 5-10. Review of outstanding incidents in American lead and copper-smelting industries during last decade of 19th century.

FUSION WELDING

Steel. The Fusion Welding of Steel, S. W. Miller. Iron Trade Rev., vol. 69, nos. 21 and 22, Nov. 24 and Dec. 1, 1921, pp. 1346-1349 anq 1422-1426, 17 figs. Advantages and limitations of oxy-acetylene, electric and thermit processes. Low-carbon steel best adapted to welding. (Abstract.) Paper presented at Am. Iron & Steel Inst.

G

GAGES

Go and not Go. The Need of Gauging for Modern Manufacturing. A. C. Wickman. Can. Machy., vol. 26, no. 17, Oct. 27, 1921, pp. 33-36, 3 figs. Discusses limits in the tapped hole, go and not-go gages, limit of microscopic magnification.

GAS MAINS

Corrosion. External Corrosion of Mains and Services, J. G. Taplay. Gas World, vol. 75, no. 1943, Oct. 15, 1921, pp. 349-250. Discusses electrolytic, acid, and alkaline corrosion. Describes experiments made to determine effect of calcium bicarbonate in earth and wall plaster.

GAS PRODUCERS

Calculations of Gases. Calculations Regarding Gas in Gas Generator With Steam Added to Air Blowing (Calculs comparatifs au sujet des gaz de gazogène, dans le cas d'addition de vapeur d'eau à l'air soufflé), J. Seigle. Revue de Métallurgie, vol. 18, no. 9, Sept. 1921, pp. 608-618, 7 figs. Discusses calorific power per cubic meter, calorific power of the volume of gas from 1 kg. of coal, etc.

Ebelmen. The Fused Ash Gas Producer (Le gazogène à fusion des cendres), A. Fichet. Le Génie Civil, vol. 79, no. 16, Oct. 15, 1921, pp 329-332, 2 figs. Describes Ebelmen system principally, also the Rehmann system.

Lignite Briquets for. Using Lignite Briquettes in Gas Generators (Essais d'utilisation de briquettes de lignite pour le chauffage de fours à gazogène), De Groote. Chaleur et Industrie, vol. 2, no. 18, Oct. 1921, pp. 661-666. Describes favorable experiments with a battery of three Morgan generators; composition of briquettes used, heat balance, ash, composition of gas, etc.

GEARS

Helical. Cutting Helical Gears on Automatic Machine, H. A. Wilson. Can. Machy. vol. 26, no. 19, Nov. 10. 1921, pp. 29-33, 13 figs. Various operations on automatics, including making of stud; dust cap cutting helical gears; chart showing tools used; machine equipped with rear end threading attachment.

Herringbone. Double Helical or Herringbone Gears, Howard H. Talbot. Iron Age, vol. 108, nos. 23 and 24, Dec. 8 and 15, 1921, pp. 1469-1473 and 1531-1533, 17 figs. Dec. 8: Elements of design to combine adequate strength with smooth and continuous action and minimum of friction of contact surfaces. Dec. 15: Use of long addenda in pinion and short addenda in driven gear, to increase the "follow through."

Maag. Maag Gearing, L. J. Le Mesurier. Engineering vol. 112, no. 2919, Dec. 9, 1921, pp 801-805, 20 figs. Describes system of gearing and methods of production developed by Maag Gear Co., Zurich, Switzerland, with which means have been found which enable straight-tooth spur gears to be employed successfully under conditions demanding highest possible peripheral speeds and loads per unit width of tooth. Describes entirely novel grinding process. (Abstract.) Paper read before North-East Coast Instn. Engrs. & Shipbuilders.

GRINDING

Steel Billet. Modern Method of Steel Billet Grinding, R. H. Cannon. Forging & Heat Treating, vol. 7, no. 11, Nov. 1921, pp. 557-559, 3 figs. Advantages of grinding over chipping in relation to wheel cost, labor cost and overhead. Making grinding wheel test.

H

HANDLING MATERIALS

Factories. An organized Transportation Department, John A. MacCrea. Management Eng., vol. 1, no. 6, Dec. 1921, pp. 327-329, 4 figs. Describes briefly organization and principal features of operation of department for moving of material.

Trucks as Conveyors. Making the Truck an Asset in Management, Edward H. Tingley. Management Eng., vol. 1, no. 5, Nov. 1921, pp. 267-271, 9 figs. How special types may be used to save floor space, provide effective storage and minimize moving time between operations.

Waste Elimination. Material Handling an Important Factor in the Elimination of Industrial Waste, H. V. Coes. Mech. Eng., vol. 43, no. 12, Dec. 1921, pp. 803-804 and 825. Points out opportunities in almost every branch of industry to reduce large wastes in material handling. Examples of savings effected, and how to arrive at best method.

HARDNESS

Measurement of Steel Balls. Schleroscope Hardness of Steel Balls, Arthur L. Collins. Iron Age, vol. 108, no. 22, Dec. 1, 1921, pp. 1391-1393, 5 figs. Widely varying results on different sizes. Esplanation of cause and suggested remedy.

Testing. The Hardness Testing of Metals. Eng. Production, vol. 3, no. 58, Nov. 10, 1921, pp. 436-440, 11 figs. Discussion of modern methods. (Abstract.) Progress report of Committee of Eng. Div. of U.S. Nat. Research Council.
The Use of the Scleroscope on Light Specimens of Metals, Fred S Tritton. Metal Industry (Lond.), vol. 19, no. 19, Nov 4, 1921, pp. 361-364, 4 figs. Describes experiments undertaken to find out whether errors existed when using ordinary methods of support, and if so, to find some method of support that would eliminate them.

HEAT TRANSMISSION

Air Space. Air Space Transmission, Percy Nicholls. Jl. Am. Soc. Heating & Ventilating Engrs., vol. 27, no. 8, Nov. 1921, pp. 783-790, 3 figs. Includes abstract of paper by H. C. Dickinson and M. S. Van Dusen on the testing of thermal insulators and presents table prepared by Bur. of Standards, separating, values for radiation and convection.

HEATING, ELECTRIC

Development, Switzerland. The Development of Electric Heating in Switzerland (Die Entwicklung der elektrischen Heizumg in der Schweiz). Gesundheits-Ingenieur, special no., July 1921, pp. 18-27, 15 figs. Describes arrangements developed by Sulzer Bros., Winterthur, Switzerland, in reconstruction of existing hot-water installations, steam and hot-water central-heating plants for use of electricity.

Hot-Water. The Electric Pumping Hot-Water Heating System in the Repair Shop for Electric Locomotives of the Swiss Federal Railway in Bellinzona (Die elektrische Pumpen-Warmwasserheizung in der Reparaturwerkstätte für elektrische Lokomotiven der Schweiz. Bundesbahnen, in Bellinzona. Schweiz. Elektrotechnischer Verein Bul., vol. 12, no. 10, Oct. 1921, pp. 270-274, 4 figs. Describes electric heating installation believed to be largest of its kind.

HEATING, FACTORY

Ventilation and. Heating and Ventilation of Factories, H. H. Angus. Contract Rec., vol. 35, no. 50, Dec. 14, 1921, pp. 1085-1088. General outline of principles involved and methods adopted to maintain satisfactory working temperatures and atmospheric conditions. Paper before Toronto Branch Am. Soc. Mech. Engrs.

HELIUM

Airships. Helium for Airships. Aviation, vol. 11, no. 22, Nov. 28, 1921, p. 635 Discusses available supply, cost of production, repurification plant, etc.

HIGHWAYS

American Practice. A British View of American Highway Practice, A. Dryland. Eng. News-Rec., vol. 87, no. 22, Dec. 1, 1921, pp. 892-894. American vehicle weights regarded as light. Bituminous surfacing for worn concrete roads suggested. Highway research commended.

Cost, Reducing. Can the Cost of Highways be Reduced? Contract Rec., vol. 35, no. 48, Nov 30, 1921, pp 1039-1041. Highway Division of Asso. Gen. Contractors of America have drawn up report indicating factors, exclusive of direct construction charges, which increase cost of hard surfaced roads. See also Eng. & Contracting, vol. 56, no. 23, Dec. 7, 1921, pp. 526-527.

HYDRAULIC TURBINES

BREAKDOWN. Investigation of Breakdown of 30,000-Kw. Turbine. Power, vol. 54, no. 21, Nov. 22, 1921, pp. 788-793, 13 figs. Account of accident in Schuylkill plant of Philadelphia Elec. Co. and conclusions from investigation. Points out that abrupt changes of section and formation of sharp angles in design of bucket wheels should be avoided.

DESIGN. Certain Features Relating to Hydraulic Turbine Design and Settings, E. W. Burbank. Proc. La. Eng. Soc., vol. 7, no. 4, Aug. 1921, pp. 150-173, 8 figs. Discusses formulas and terms used, reaction and impulse types of turbines and their operation.

SAND-REMOVING PLANT. Wear in Hydraulic Turbines and How to Avoid it (L'usure des turbines hydrauliques, ses conséquences et les moyens d'y parer), H. Dufour. Bulletin Technique de la Suisse Romande, vol. 47, no. 22, Oct. 29, 1921, pp. 253-256, 6 figs. Describes sand-removing plant at Monthey works of Société pour l'Industrie Chimique à Bâle.

HYDROELECTRIC DEVELOPMENTS

QUEENSTON-CHIPPAWA. The Chippawa-Queenston Power Canal. Can. Engr., vol. 41, no. 23, Dec. 8, 1921, pp. 1 and 10, 6 figs. Big Ontario power development practically completed. Canal is 12½ mi. long with max. depth of 145 ft.; available gross head, 315 ft.; width of concrete section, 48 ft.; depth of water, 35-40 ft.; total earth excavation, 13,299,000 cu. yd.; total rock excavation, 4,182,000 cu. yd.; max. capacity of each turbine, 60,000 hp.; total weight of each complete generating unit, 1,853,000 lb.

ST. LAWRENCE RIVER. Hydro Report on St. Lawrence River. Can. Engr., vol. 41, nos. 21, 22, 23, and 24, Nov. 24, Dec. 1, 8 and 15, 1921, pp. 1, 4-5; pp. 1, 4, 5, 9, and 10, 5 figs.; pp. 4-5; and 9-10. Suggests three alternative schemes for power development and gives cost of each. Study of physical conditions Ontario Hydroelectric Commission's engineering report to Int. Joint Commission.

The St. Lawrence Power Development. Can. Engr., vol. 41, no. 22, Dec. 1, 1921, pp. 1, 10, 11 and 12, 4 figs. Salient features of report by Hugh L. Cooper to Int. Joint Commission on navigation and power in St. Lawrence River. Recommends Croil Island as site for main dam and power plant.

HYDROELECTRIC PLANTS

220,000-VOLT. First 220,000-Volt Station Completed. Elec. World, vol. 78, no. 23, Dec. 3, 1921, pp. 1115-1119, 12 figs. Describes Big Creek No. 8 Station built by Southern Cal. Edison Co.; has 22,500 kw. vertical reaction turbine; lines are operated at 150,000 volts and will be at 220,000 volts ultimately.

I

INDUSTRIAL MANAGEMENT

ASSEMBLING METHODS. Saving time in Assembling, Albert A. Dowd and Frank W. Curtis. Machy. (N.Y.), vol. 28, no. 4, Dec. 1921, pp. 296-300, 6 figs. Examples showing savings resulting from investigation of assembling methods.

EXECUTIVE CONTROL CHARTS. Comparability of Executive Control Charts, Arthur R. Burnet. Management Eng., vol. 1, no. 5, Nov. 1921, pp. 283-288, 7 figs. Fundamental requirement of the "Z" chart and how it may be secured.

FACTORY INVESTIGATIONS. How Factory Investigations Reduce Costs. Machinery (Lond.), vol. 19, no. 476, Nov. 10, 1921, pp. 149-154, 7 figs. Discusses handling of materials, inspection and salvage. manufacturing a fly-wheel pulley, savings affected by use of punch press, etc.

FINANCIAL CONTROL. The Parallel of Control in Business, Frederic H. Leland. Management Engr., vol. 1, no. 6, Dec. 1921, pp. 348-350, 1 fig. Points out that there are two scales of parallel lines of business control, a major scale, which shows correctly amount of money involved in principal activities of business; and minor scale which shows money involved in greater detail than [illegible] scale.

[illegible] Leaks We Have Stopped, A. H. Cubberley. Factory, vol. 27, no. 6, Dec. 1921, pp. 743-747, 2 figs. Analysis of principal financial leaks and how to stop them. Practice at E. I. du Pont de Nemours Co. Works.

FUTURE OF. Scientific Management—XXXIII, Henry Atkinson. Eng. & Indus. Management, vol. 6, no. 19, Nov. 10, 1921, pp. 529-531. Future of scientific management. (Concluded.)

GANTT CHARTS. The Gantt Chart—IV, Wallace Clark. Management Eng., vol. 1, no. 5, Nov. 1921, pp. 279-282, 3 figs. Its application to plant load.

[illegible] Plants, George H. Shepard. Machy. (N.Y.), vol. 28, no. 4, Dec, 1921, pp. 268-270, 1 fig. Organization of [illegible]

[illegible], Howell B. May. Indus. [illegible], Dec. 1921, pp. 341-344. How new spirit of team- [illegible] co-operative inter- [illegible] foremen and workers and [illegible]

[illegible] Applying "Moving Average" Charts to Industry, [illegible]nent Eng., vol. 1, no. 6, Dec. 1921, pp. 343-348, 9 figs. D[illegible] in production and how it is reduced.

PRODUCTION METHODS. Modern Production Methods — XXIV, W. R. Basset. Am. Mach., vol. 69, no. 23, Dec. 8, 1921, pp. 950-955, 7 figs. Setting piece rates. Points out that incentive factor is as important as securing results for wage given. Examples of rate derivation. Why piece rates should not be cut.

Productive Ways and Means, H. Darbyshire. Eng. & Indus. Management vol. 6, no. 22, Dec. 1, 1921, pp. 618-621, 4 figs. Writer deals with number of essential details with which management and supervising staff of any industrial organization should become familiar.

PROGRESS DEPARTMENT. Estimating and Handling Output of "Modifications." Eng. & Indus. Management, vol. 6, no. 21, Nov. 24, 1921, pp. 601-603. Describes progress organization of factory, where, although lines are standardized and produced upon more or less repetition basis, these lines may be modified time and again to meet specific requirements of customers.

RECORDS FOR ELECTRICAL DEPARTMENT. Efficient Record System for Industrial Electrical Department, J. Elmer Housley. Elec. World, vol. 78, no. 21, Nov. 19, 1921, pp. 1015-1018, 1 fig. Gives forms for motors, lamps, trucks, etc., and describes how to use them.

STORING MATERIALS. Management Problems of the Small Factory, Ernest Cordeal. Indus Management, vol. 62, no. 6, Dec. 1921, pp. 334-340, 7 figs. How Materials are effectively handled and stored.

TOOLROOM ORGANIZATION. Organizing Tool Production. Eng. Production, vol. 3, no. 59, Nov. 17, 1921, pp. 462,466, 15 figs. Procedure in the works drawing office and toolroom.

See also Time Study.

INDUSTRIAL ORGANIZATION

ENGINEERING DEPARTMENT. Organization of an Engineering Department, W. E. Irish. Indus. Management, vol. 62, no. 6, Dec. 1921, pp. 357-361, 1 fig. Author shows plan of organization found suitable to requirements of large steel company and gives account of its working.

KNITTING MILLS. The Organization of Knitting Mills, Carle M. Bigelow. Management Eng., vol. 1, nos. 5 and 6, Nov. and Dec. 1921, pp. 261-265, 7 figs. and pp. 359-364, 6 figs. Nov.: Standardizing physical conditions. Deals with plant layout and routing. Dec.: Standardizing control of material.

INDUSTRIAL RELATIONS

CONSTRUCTION INDUSTRIES. Development of Satisfactory Relationship Between Employer and Employe in Construction Industry, Ernest T. Trigg. Eng. & Contracting, vol. 56, no. 21, Nov. 23, 1921, pp. 479-481. (Abstract). Paper presented before joint meeting of Acad. Political Sci. and Am. Indus. Relations Assn. See also Contract Record, vol. 35, no. 47, Nov. 23, 1921, pp. 1021-1023.

HUMAN FACTOR. The Human Factor in Industry—III, Clarence H. Northcott. Indus. Management, vol. 62, no. 6, Dec. 1921, pp. 363-369. Deals with psychology, instincts and tendencies of worker.

OPEN-SHOP FOUNDRY. The Transition to an Open-Shop Foundry, Paul R. Ramp. Iron Age, vol. 108, no. 22, Dec. 1, 1921, pp. 1395-1398. Methods used with success in training molding-machine workers, with view to increased output.

TRAINING EXECUTIVES. Training the Industrial Relations Executive, Edward S. Cowdrick. Management Eng., vol. 1, no. 6, Dec. 1921, pp. 329-330. Notes on college courses in industrial relations.

WORKS COUNCIL. Industrial Democracy in Great Britain. Clarence H. Northcott. Management Eng., vol. 1, no. 5, Nov. 1921, pp. 295-297. Deals with establishment of a works council; qualifications for membership and voting; and how council is organized.

INSPECTION

SYSTEMS. Inspectors' Reports, Examples and Methods. Eng. & Indus. Management vol. 6, no. 20, Nov. 17, 1921, pp. 570-573. Discussion of certain systems of inspection, with view to demonstrating their efficiency under given conditions.

INTERNAL-COMBUSTION ENGINES

MARINE. Internal Combustion Engines in Marine Service—II, Charles Edward Lucke. Jl. Am. Soc. Mar. Draftsmen, vol. 8, no. 3, Oct. 1921, pp. 47-57, 10 figs. Compares new standards of turbine steamer and motorship machinery. Paper read before Franklin Inst.

See also Airplane Engines; Automobile Engines; Diesel Engines; Gas Engines; Oil Engines; Semi-Diesel Engines.

IRON

ELECTRODEPOSITION OF. The Industrial Future of Electro-Deposited Iron, W. E. Hughes. Chem. Age (Lond.), vol. 5, no. 124, Oct. 29, 1921, pp. 521-523, 4 figs. Discusses results of research work and microscopic examination of structure of deposited iron. Sees good future for its application.

ELECTROLYTIC. Commercial Production of Electrolytic Iron, C. P. Perin and Donald Belcher. Min. & Metallurgy, no. 180, Dec. 1921, pp. 17-18, 2 figs. Describes French process consisting of electrolyzing a concentrated solution of ferrous chloride at temperature of 75 deg. cent. Anodes are of cast iron, cathode is a rotating mandrel of steel. With this process tubes and sheets of any desired gage can be made.

IRON ORE

DIRECT REDUCTION. Production of Iron by Direct Reduction of the Ore by the Electrothermal Process (La Production du fer par reduction directe des minerais par voie électrothermique), Marcel Guedras. La Technique Moderne, vol. 13, no. 6, June 1921, pp. 264-265. Describes levoz process, its principles, apparatus and practical results.

IRON AND STEEL

CHEMICAL INDUSTRIES, RELATIONS TO. Relations of the Iron and Steel and Chemical Industries, James M. Camp. Iron Age, vol. 108, no. 21, Nov. 24, 1921, pp. 1329-1331, 1 fig. Notes on chemicals consumed by steel makers; steel used by chemical plants; role of by-products from coke. Paper read before Am. Iron & Steel Inst.

SWEDEN. The Swedish Iron and Steel Industry, Raw Material, vol. 4, no. 10, Oct. 1921, pp. 344-348, 8 figs. Historical review of its development.

IRON, PIG

CALCULATING FOUNDRY VALUE OF. Calculating a Foundry Iron Value, Y. A. Dyer. Iron Age, vol. 108, no. 24, Dec. 15, 1921, pp. 1547-1548. Unit valuation of elements in foundry pig irons. Silicon, manganese and phosphorus considered as metalloids. Carbon and sulphur grouped as Fe.

L

LABOR

CLASSES TO BE AVOIDED. Three Classes of Labor to Avoid, H. A. Haring. Indus. Management, vol. 62, no. 6, Dec. 1921, pp. 370-373. Discusses prejudices and habits displayed by men in certain occupations, and describes effects of certain classes of employment upon individual's fitness for modern industrial work.

LATHE TOOLS

AUTOMOBILE FORGINGS. Cost-Reducing Tooling Equipments, Ralph E. Flanders. Machy. (N.Y.), vol. 28, no. 4, Dec. 1921, pp. 301-305, 13 figs. Employed for machining steering knuckles and other automobile forgings at high rate of production.

LATHES

AUTOMOBILE WORK ON TURRET Automobile Production Work on Turret Lathes, Edward K. Hammond. Machy. (N.Y.), vol. 28, no. 4, Dec. 1921, pp. 261-264, 7 figs. Time-saving and cost-reducing methods developed for use in engine department of motor-car plant.

LIGHTING

HIGHWAYS. Illumination of Highways, C. A. B. Halvorson and R. B. Hussey. Eng. & Contracting, vol. 56, no. 23, Dec. 7, 1921, pp. 535-536, 2 figs. Describes new type of reflector and equipment known as highway lighting unit, consisting of series of nested or concentric parabolic reflectors made of steel and coated with white porcelain enamel; reflectors are so arranged that lignt is directed up and down highway and as much as possible of it confined to road surface. (Abstract). Paper read before Am. Soc. Mun. Improvements.

INDUSTRIAL. Good Lighting Increases Production, J. M. Hickerson. Indus. Management, vol. 62, no. 6, Dec. 1921, pp. 325-328, 2 figs. Summary of major facts brought out by survey of industrial lighting conditions.

Illuminating Engineering: The Future Field' J. H. Asdell. Eng. & Indus. Management, vol. 6, no. 16, Oct. 20, 1921, pp. 441-444. Practical notes on planning an efficient scheme of lighting for industrial purposes, together with simple formula for calculation of illumination in general practice.

METAL-WORKING PLANTS. Lighting Metal-Working Plants to Increase Production, A. L. Powell. Elec. World, vol. 78, no. 22, Nov. 26, 1921, pp. 1069-1072, 7 figs. Proper intensities, spacings and fixtures for benches, machine tools, sheet-metal work, assembling, painting, etc.; general or "localized-general" system of illumination is satisfactory in most cases.

LOCOMOTIVES

FEEDWATER TREATMENT. Water Treatment From an Investment Standpoint, L. F. Wilson. Ry. Rev., vol. 69, no. 19, Nov. 5, 1921, pp. 602-604. Discusses external and internal treatment of locomotive feedwater.

FUEL CONSUMPTION. The Effect of Grade on Locomotive Coal Consumption, George S. Chiles. Ry. Rev., vol. 69, no. 22, Nov. 26, 1921, pp. 715-719, 2 figs. Actual operation of modern equipment illustrates influence of ascending and descending grades.

HORNBLOCKS, MACHINING. Machining Locomotive Hornblocks. Eng. Production, vol. 3, no. 58, Nov. 10, 1921, p. 451, 4 figs. Describes operation on horizontal milling machine.

MODERN DESIGN. Modern Locomotive Engine Design and Construction—LXXV. Ry. Engr., vol. 42, no. 502, Nov. 1921, pp. 421-424 and 439, 3 figs. Discusses coupling-rod design and construction, coupling-rods stresses, etc.

OIL-BURNING. The Lentz Hydraulic Drive for Heavy-Oil Locomotives (Das Flüssigkeitsgetriebe von Lentz für Schwerölkomotiven), H. Wittfeld. Zeit, des Vereines deutscher Ingenieure, vol. 65, no. 45, Nov. 5, 1921, pp. 1160-1163, 4 figs. Discusses efforts heretofore made for rendering internal-combustion engines for heavy oil feasible for locomotive drive with aid of the Lentz hydraulic drive; and gives operating results with trial of first heavy-oil locomotive with such drive.

STEAM PRODUCTION AND USE. On the Question of Economic Production and Use of Steam on Locomotives, G. J. Churchward. Bul. Int. Ry. Assn., vol. 3, no. 10, Oct. 1921, pp. 1527-1538, 1 fig. Abstract of replies to questions on superheated steam, superheater engines and none superheater engines, feedwater treating, and special arrangements, water tube boilers, etc. Appendix describing Riegel water tube locomotive boiler.

STEAM-TURBINE. An early Steam Turbine Locomotive. Engineering, vol. 112, no. 2917, Nov. 25, 1921, p. 728, 4 figs, on p. 730. Details of Belluzzo steam-turbine locomotive constructed in 1908 by Societa Anonima Officine Mecanniche, Milan, and recently dismantled.

STOKER-FIRED. The Locomotive Stoker As An Operating Factor, Frank P. Roesch Ry. Rev., vol. 69, no. 21, Nov. 19, 1921, pp. 685-687. How stoker-fired locomotives can be operated to obtain maximum operating efficiency with minimum expense.

Performance of the Hanna Locomotive Stoker on the Norfolk & Western Railway. Ry & Locomotive Eng., vol. 34, no. 11, Nov. 1921, pp. 308-310, 1 fig. Describes special trial trips showing efficiency of this stoker. Particulars of firebox conditions., etc.

SUPERHEATER. Superheater Practice in American Locomotives. Boiler Maker, vol. 21, no. 11, Nov. 1921, pp. 301-305, 12 figs. Describes most successful methods developed for handling superheater work by railroads.

TRUCKS. On the Question of Bogies (Trucks), Axle and Springs of Locomotives, George Hughes. Bul. Int. Ry. Assn., vol. 3, no. 10, Oct. 1921, pp. 1589-1674, 84 figs. Includes appendixes containing tabular statements on kinds of bogies used by various companies, method of fixing springs for driving and coupled wheels, springing, cylinders, heating surpaces and particulars of two-wheel trucks.

2-8-2- MIKADO. 2-8-2- Type Locomotives for the Nickel Plate. Ry. Mech. Engr., vol. 95, no. 12, Dec. 1921, pp. 737-738, 4 figs. Design based on U.S.R.A., light Mikado with improvements in details. Booster handles 22 per cent additional tonnage.

LUBRICATION

AUTOMOBILE CHASSIS. Various Methods of Chassis Lubrication, Cornelius T. Myers. Automotive Industries, vol. 45, no. 22, Dec. 1, 1921, pp. 1067-1069. Compares lubricating materials and discusses various methods and devices. Condensed from paper read before Soc. Automotive Engrs.

PRIME MOVERS. The Lubrication of Prime Movers, C. H. Bromley. Mech. World, vol. 70, no. 1821, Nov. 25, 1921, pp. 428-429. Discusses oils for steam turbines, emulsion and sludge, Diesel-engine lubrication, etc. (Abstract). Paper read before System Operators' Assn.

LUMBER

CARE IN STORAGE. The Care and Protection of Lumber in Storage, H. A. Sackett. Ry. Age, vol. 71, no. 24, Dec. 10, 1921, pp. 1133-1136, 9 figs. Sanitary precautions to prevent decay; building of piles; and protection against fire.

M

MAGNESIUM ALLOYS

ELECTRON METAL. The Magnesium Alloy "Electron," S. Beckinsale. Metal Industry (N.Y.), vol. 19, no. 11, Nov. 1921, p. 433. Gives chemical analysis of three specimens; hardness and compression tests; microscopic examination; machining properties.

MACHINE SHOPS

DESIGN. The Design and Construction of Engineering Workshops—XXIV, Ernest G. Beck. Mech. World, vol. 70, no. 1817, Oct. 28, 1921, pp. 342-343, 6 figs. Discusses orientation of roofs; glare, glazing, screening, ventilation, etc. (To be continued.)

MACHINE TOOLS

AUTOMATIC. Automatic Machine Tools in Relation to Production Problems, Henry Baker. Machinery (Lond.), vol. 19, no. 477, Nov. 17, 1921, pp. 181-185. Application of mathematical methods to tool setting; idle time; stoppages; economy of extra tools or extra machines.

IMPROVING DETAILS. Tool Details that Improve the Finish of Work in a Machine Shop. Eng. & Indus. Management, vol. 6, no. 21, Nov. 24, 1921, pp. 586-589, 12 figs. Gives practical advice on raising standard of quality of work, and details for improving machine tools, together with explanatory diagrams.

OPERATION CONTROL. Some Notes on the Operating Control of Machine Tools, N. F. Stockbridge. British Machine Tool Eng., vol. 1, no. 12, Nov.-Dec. 1921, pp. 406-412, 11 figs. Discusses the various adjustments of the radial drilling machine up to 4 ft. 6 in. radius.

METAL SPRAYING

SCHOOP PROCESS. Metal Spraying by the Schoop Process, Sidney Mornington. Compressed Air Mag., vol. 26, no. 11, Nov. 1921, pp. 10293-10295, 5 figs. Promises to be of great industrial value for applying zinc or lead to bridges, pontoons, railway cars, and other equipment exposed to action of the elements or exhaust gases.

METALS

FATIGUE. An Investigation of the Fatigue of Metals, H. F. Moore and J. B. Kommers. University of Illinois Bul., vol. [illegible], no. 8, Oct. 24, 1921, 185 pp., 46 figs. Report of investigation [illegible] Engineering Experiment Station in co-operation with Nat. Research Council, Engineering Foundation, and Gen. Elec. Co. Concludes that phenomenon known as fatigue under repeated stress might better be called progressive failure of metals. Most probable explanation seems to be that such failure is progressive spread of microscopic fractures. Bibliography.

[illegible] Eng. & Contracting, vol. [illegible], no. 26, Dec. 28, 1921, pp. 593-596, 5 figs.

HARDENING. On the Theory of the Hardening of Metals, Kotaro Honda. Chem. & Met. Eng., vol. 25, no. 22, Nov. 30, 1921, pp. 1001-1003. Thinks that hardness in metals is due in part to forces between atoms and in part to an interlocked, strained crystalline structure.

LIGHT AND EXTRA LIGHT. Light and Extra Light Metals (Les Métaux blancs légers et ultra-légers), R. de Fleury. La Fonderie Moderne, no. 10, Oct. 1921, pp. 294-298. Discusses alloys with aluminum or magnesium base; compares light and heavy metals casting of aluminum; treatment of light metals alloys of aluminum.

MILLING

PROBLEMS. Some Miller Problems—How They Were Solved., H. A. Wilson. Can. Machy., vol. 26, no. 20, Nov. 17, 1921, pp. 33-34, 4 figs. Milling steel parts to within limits of .002 in. at the rate of 600 per hour; milling four tables at one time, value of gang milling.

MILLING CUTTERS

ACTION OF. On the Art of Milling, John Airey. Mech. Eng., vol. 43, no. 12, Dec. 1921, pp. 783-789 and 798, 17 figs. Account of invrstigation undertaken at University of Michigan for purpose of finding rational basis for action of milling cutter. It is shown that metal is removed more efficiently with thick than with thin chips; thus, under usual conditions, cutter with fewest teeth gives greatest efficiency. Formulas for determining number of teeth for known diameter of cutter and for determining depth are included.

MOLDING METHODS

JARRING MACHINES. Germans Jar Molds Mechanically, U. Lohse. Foundry, vol. 49, no. 23, Dec. 1, 1921, pp. 934-938, 8 figs. Compares different methods of packing sand in molds; mechanical jarring machines, both with and without schock absorbers are described in detail. (Abstract). Staul und Eisen, Sept. 1, 1921.

MOTOR BUSES

COSTS OF CARS AND Bus and Car Costs Compared, H. L. Andrews. Elec. Ry. Jl., vol. 58, no. 18, Oct 29, 1921, pp. 769-771. Compares estimates on operating costs of motor bus, trolley bus and safety car, as given by Thirlwall and Stocks, and defends figures of Thirlwall.

GLOUCESTER, MASS. Transportation by Motor Bus in Gloucester. Elec. Ry. Jl., vol 58, no. 18, Oct. 29, 1921, pp. 773-777, 6 figs. All urban and suburban transportation is by motor bus. Describes equipment; data on buses, fares and routes.

MOTOR-TRUCK TRANSPORTATION

COSTS. A Formula Covering Costs of Heavy Motor Trucking, Charles Hine. Ry. Age, vol. 71, no. 22, Nov. 26, 1921, pp. 1045-1046, 1 fig. Shows superiority of time basis over ton-miles or truck-miles for computing expenses.

MOTOR TRUCKS

BRITISH TYPES. Engineering Features of British Truck Models, M. W. Bourdon. Automotive Industries, vol. 45, no. 20, Nov. 17, 1921, pp 958-963, 14 figs. Des[illegible] features in the 6-ton Maudslay, 4-ton Dennis, and other trucks

ELECTRIC VS GASOLINE. Electric Vehicle Operation Cheaper than Gasoline Truck, Walter R Metz. Elec. World, vol 78, no 24, Dec. 10, 1921, pp 1173-1174, 2 figs Operating costs of electric trucks in government service in Washington, D C., compared with cost of gasoline trucks under similar conditions; electric trucks superior for city requirements.

VIBRATION, REDUCTION OF. Reducing Destructive Vibration in Equipment. Elec. [illegible] 1921, pp. 805-810, 9 figs. Discusses crystallization and fatigue, experience in motor-truck field, use of ball and roller bearings, cushioning shocks, types of cushion wheels, etc.

N

[illegible]

[illegible] Measuring Flow, W. Trinks. Power [illegible] 1044-1045, 4 figs. Methods o[illegible] compressors and steam engines

O

OIL ENGINES

FUNCTION OF. Function of the Heavy Oil Engine in Connection with the General Supply of Electricity, Geoffrey Porter. Petroleum World, vol. 13, no. 254, Nov. 1921, pp. 466-470. Discusses fuels available, compares steam and oil engine stations; local versus bulk electricity supply; etc. (Abstract). Paper read before Diesel Engine Users Assn.

MARINE. Worthington Airless-Injection Oil-Engine. Motorship, vol. 6, no. 11, Nov. 1921, pp. 872-875, 12 figs. Details of a new marine motor for small commercial vessels developed at Blake works, East Cambridge; successful tests run on regular steam-boiler fuel oil with low-consumption results.

TWO-CYCLE. A Two-Cycle Oil Engine. Engineer, vol. 132, no. 3438, Nov. 18, 1921, p. 544, 3 figs. Describes two-stroke hot-bulb type constructed by Marshall, Sons & Co., Ltd., Gainsborough.

OIL FUEL

TEXTILE MILLS. Oil Fuel for Textile Works, J. Veen Stevens. Eng. & Indus. Management, vol. 6, no. 21, Nov. 24, 1921, pp. 597-598. Tests for standardizing quality. Paper read before British Assn. of Mgrs of Textile Works.

OIL SHALES

SCOTLAND. The Scottish Oil-Shale Industry, F. E. J. Foxall-Smedley. Petroleum World, vol. 13, no. 254, Nov. 1921, pp. 445-452, 5 figs. Describes processes of destructive distillation and apparatus, refinery processes and apparatus, and by-products.

OILS

INSULATING. A Research on Insulating Oils, E. B. Wedmore. Electrician, vol. 87, no. 2272, Dec. 2, 1921, pp. 702-704, 5 figs. Discusses spark gaps for testing electric strength of insulating oils and gives results of investigation undertaken to establish a basis which would permit the correlation of measurements taken with different types of spark gaps upon commercial oils.

OPEN-HEARTH FURNACES

PORTS, IMPROVING. Improving Ports of Open Hearths, John W. Kagarise. Iron Trade Rev., vol. 69, no. 22, Dec. 1, 1921, pp. 1417-1421 and 1426, 6 figs. Various types of water-cooled ports are described. Using by-product coke-oven gas introduces difficulty. Paper read before Am. Iron & Steel Inst.

Improvements in Open-Hearth Port Construction, John W Kagarise. Iron Age, vol. 108, no. 21, Nov. 24, 1921, pp. 1324 and 1326-1329. Early types; water-cooled ports; the McKune system and the Venturi and Egler furnaces with some results. Paper read before Am. Iron & Steel Inst.

OXY-ACETYLENE WELDING

MILD STEEL. A Survey of Oxy-acetylene Welding, Lorn Campbell, Jr. Jl. Soc. Automotive Engrs., vol. 9, no 5, Nov. 1921, pp 320-321 and (discussion) 321-322. Discusses the subject as a factor of efficiency in manufacturing; gives reasons why rivets should be replaced by welds; outlines mild steel welding and describes apparatus.

P

PAINTS

DRYING. Artificial versus Natural Means of Drying Paint and Varnish, R. E. Lippert. Jl. Soc. Automotive Engrs., vol 9, no 5, Nov 1921, pp 335-340 and (discussion) 340-343, 13 figs. Describes process for drying coats of paint and varnish by adding heat and moisture simultaneously to air surrounding siccat've coatings through employment of mechanical devices; also describes several humidifying devices.

PAPER MANUFACTURE

SULPHITE PULP, COOKING. Variables in the Cooking of Sulphite Pulp, Benjamin T Larrabee. Paper, vol 29, no 9, Nov 2, 1921, pp 15-16. Discusses variations in operation at different mills, determination of the completion of a cook, digester operations, etc. Paper read before Am. Pulp & Paper Mill Superintendents' Assn.

PATTERNMAKING

LAYOUT AND EQUIPMENT. Pattern-making Lay-out and Equipment, James Edgar. Eng. & Indus Management, vol 6, no. 22, Dec. 1, 1921, pp. 624-625. Practical advice covering essential feature of organization. Notes on type of vice, oosition of machines, and sawing machine.

PATTERNS

STORAGE. The Organization of a Pattern Stores, H. Varley. Eng. & Indus. Management, vol. 6, no 19, Nov 1921, pp. 522-525, 10 figs. Describes storage method and manner of running stores which is claimed to be common-sense application of systematic routine reduced to its simplest terms.

PAVEMENTS, BRICK

Foundations. Foundations for Brick Pavements, F. M. [illegible]. Can. Engr., vol. 41, no. 21, Nov. 24, 1921, pp. 1 and [illegible], 4 figs. Construction of rigid and non-rigid foundations for vitrified brick highway surfaces. Mixing and laying concrete for rigid foundations. Paper read before Highway Eng. Conference, University of Pa.

PEAT

Air-Drying. The Air-Drying of Peat, Ernest V. Moore. [illegible] Industry, vol. 40, no. 19, Oct. 15, 1921, pp. [illegible]-230[illegible]. Notes on process of manufacturing air-dried peat fuel, and uses.

PIERS

Testing Concrete Foundation. Testing Concrete Foundation Piers of Chicago Union Station Co., R. F. Imler. Eng. World, vol. 19, no. 6, Dec. 1921, pp. 399-400, 3 figs. By use of locomotive crane travelling on temporary tracks, 1200 tons of 130-lb. steel rail were unloaded from cars and piled upon platform formed by 16 steel I-beams and four plate and angle girders.

PILES

Gages for Test Driving. The Gauging of Penetration in Pile-Driving, Ernest Latham. Engineering, vol. 112, no. 2916, Nov. 18, 1921, pp. 684-686, 7 figs. Results of tests with inertia gages.

PIPE, CAST IRON

Centrifugal Casting. Manufacture of Cast Iron Pipe by Centrifugal Methods, F. W. Hudson. Contract Rec., vol. 35, no. 48, Nov. 30, 1921, pp. 1038-1039, 2 figs. Describes the DeLavaud process and machinery. Comparison of centrifugal product with sand-cast pipe.

PIPE, STEEL

Protective Covering. Protective Covering for Steel Pipe, L. M. Klauber. Gas Age-Rec., vol. 48, nos. 14 and 15, Oct. 22 and 29, 1921, pp. 478-484 and 514-516, 21 figs. Oct. 22: Describes method of covering pipe for protection in corrosive soils used by San Diego Consolidated Gas & Elec. Co. The clean pipe is dipped into hot asphalt, wrapped with chemically and electrically resistant asbestos felt, redipped in asphalt and wrapped spirally with burlap. Oct. 29: Tests with some coverings, materials for wrapping, life of pipe, etc.

PISTONS

Machining Bosses. Machining Piston Bosses. Eng. Production, vol. 3, no. 58, Nov. 10, 1921, p. 450, 3 figs. Describes method for intensive production.

POLE LINES

Longer Spans. Longer Spans Proposed for Rural Lines. Elec. World, vol. 78, no. 24, Dec. 10, 1921, pp. 1168-1170, 3 figs. By selecting conductors with high elastic limit and properly guying poles at sharp corners and dead-ends urban factors of safety can be obtained with poles placed 250 ft. apart.

POWER

Costs. How to Follow Up Power Costs—II, N. A. Craigue. Indus. Management, vol 62, no. 6, Dec. 1921, pp. 354-356, 1 fig. Discusses various methods of distribution, such as by estimated percentages, by metered amounts, and unit cost or cost constant method.

Hydraulic, Storage of. Mechanical Storage of Power in Italy, G. Müller. Power, vol. 54, no. 21, Nov. 22, 1921, pp. 804-805, 2 figs. Discusses storage of hydraulic energy by using surplus power during periods of high water or low demand, to pump water from tailrace back to higher level for use during peaks or periods of drought. Notes on the Viverone plant, Funghera mechanical storage plant, and a large one under construction.

POWER GENERATION

Fuel Economy. Fuel Economy by the Adoption of Scientific Management in Steam (Power) Generation and Utilization, David Brawnlie. Eng. & Indus. Management, vol. 6, nos. 17, 18, 19, 20, 21 and 22, Oct. 27, Nov. 3, 10, 17, 24 and Dec 1, 1921, pp. 475-478, 516-520, 549-552, 559-562, 593-594 and 626-630 and 637, 31 figs. Oct. 27: Boiler feedwater meters. Nov. 3: Steam meters Nov. 10: Steam meters and feedwater regulators. Nov. 17: Feedwater regulators and coal weighing. Nov. 24: Coal weighing. Dec. 1: Economizers.

POWER PLANTS

Code on Definitions and Values. Code on Definitions and Values. Mech. Eng., vol. 43, no. 12, Dec. 1921, pp. 805-810 and 821. Preliminary draft of fourth in series of 19 codes in preparation by A.S.M.E. committee on power tests codes.

Design. Developments in Power Station Design. Engineer, vol. 132, nos. 3447, 3438, 3439 and 3440, Nov. 11, 18, 25 and Dec. 2, 1921, pp. 502-504, 5 figs.; 530-532, 8 figs.; 558-559, 4 figs.; and 600-601, 7 figs. Nov. 11: Lopulco pulverized-coal feeders and equipment. Nov. 18: Self-cleaning multiple-retort stokers; ash-removal equipments. Nov. 25: Coal-storage system of Ed. Bennis & Co., Ltd., and ash removal from boiler houses. Dec. 2: Pneumatic coal-handling plant at Bankside electric generating station, London.

Oiling Systems. Central Oiling Systems for Power Plants. Power House, vol. 14, no. 21, Nov. 5, 1921, pp. 32-33. The treatment of oil for continuous use; correct lubrication; impurities; precipitation; filtration; entrained water;action of heat; filtering materials; separation of water.

Operation. Refinements of Practice in Modern Power Plants, I. L. Kentish-Rankin. Power Plant Eng., vol. 25, no. 24, Dec. 15, 1921, pp. 1190-1192. Turning steam into cold pipe lines; handling hot water, precautions for instrument piping; flue dusts and their chemical actions; moisture in superheated steam lines.

Records and Accounting. Power Plant Records and Accounting, Einar Winholt. Power Plant Eng., vol. 25, no. 24, Dec. 15, 1921, pp. 1193-1196, 6 figs. Discusses total cost of operating power plant, distribution of cost, and gives forms.

Waste in. Waste in Industrial Power Plants, David Moffat Myers. Management Eng., vol. 1, no. 6, Dec. 1921, pp. 370-371. Notes on how to determine efficiency of operation.

POWER TRANSMISSION

Waves. Wave Transmission of Power. Steamship, vol. 33, no. 389, Nov. 1921, pp. 142-154, 13 figs. Theoretical discussion by G. Constantinesco. Discusses power transmission by waves through liquids and its application to rock drills, riveters, etc. made by W. H. Dorman & Co., Shafford, Eng.

PRODUCER GAS

Coke-Oven Heating. Producer Gas for Coke Oven Heating. Colliery Guardian, vol. 122, no. 3177, Nov. 18, 1921, pp. 1403-1404, 5 figs. Discusses trend of progress in coke industry. Notes on Koppers regenerative coke oven and regenerative gas oven.

PULVERIZED COAL

Assay Muffles. Firing Assay Muffles with Pulverized Coal, E. H. Hamilton. Min. & Metallurgy, no. 180, Dec. 1921, p. 24, 2 figs. Describes satisfactory burning of pulverized coal in assay furnaces of U. S. Smelting Refining & Mining Co., Midvale, Utah. Details of furnaces.

Power-Plant Equipment. Burning Pulverized Anthracite Mine Waste, O. M. Rau. Elec. Ry. Jl., vol. 58, no. 22, Nov. 26, 1921, pp. 945-949, 8 figs. Results of tests obtained by burning pulverized anthracite coal in Philadelphia Rapid Transit Company's power plant; pulverizing equipment installed for ten boilers.

PUMPS

Air-Lift. Air-Lift in Theory and Practice, A. W. Allen. Min. & Sci. Press, vol. 123, no. 21, Nov. 19, 1921, pp. 711-712. Discusses essentials for air lifting, design of rising main, elevating solids by air lift, elasticity, and advantages and disadvantages of air lift.

Rotary. Imbye Pumping, with Special Reference to the Feuerheerd Pump, S. H. Cashmore. Colliery Guardian, vol. 122, no. 3172, Oct 14, 1921, pp. 1073-1074, 5 figs. Comparison of various types of pumps; describes the Feuerheerd pump which is claimed to have a great future. Read before South Staffordshire and Warwickshire Inst. Min. Engrs.

PUMPS, CENTRIFUGAL

Impellers. Open vs. Closed Impellers in the Brockton Sewage Pumping Plant, H. S. Crocker. Eng. News-Rec., vol. 87, no. 21, Nov. 24, 1921, pp. 854-856. Experience at Brockton, Mass., shows that open-type impeller properly designed will give greater output and higher efficiency than enclosed one for small high-speed pumps.

PYROMETERS

Féry. The Measurement of Temperature—XV, P. Field Foster. Mech. World, vol. 70, no. 1819, Nov. 11, 1921, pp. 382-383, 8 figs. Describes the Féry radiation pyrometer.

Recording and Non-Recording. Pyrometer Solves Temperature Problems, John P. Goheen. Foundry, vol. 49, no. 23, Dec. 1, 1921, pp. 938-939. Discusses non-recording and recording pyrometers and their application, temperature control of furnaces, etc. Paper to be read before Am. Inst. Min. & Met. Engrs.

R

RAILLESS TRACTION

Double-Trolley Omnibus. Trolley Omnibus Developments. Tramway & Ry. World, vol. 50, no. 25, Nov 17, 1921, pp. 257-260, 4 figs. Describes Staaker-Clough trolley omnibus with double trolley.

Europe in. Trackless Trolleys at Work Abroad, Walter Jackson. Elec. Ry. Jl., vol. 58, no. 24, Dec 10, 1921, pp. 1027-1032, 2 figs. Describes installations of Tees-side and York in England and Vienna in Austria and gives operating costs.

Trackless Trolleys. Trackless Trolleys at Work Abroad, Walter Jackson. Elec. Ry. Jl., vol. 58, no 20, Nov. 12, 1921, pp. 859-863, 4 figs. Discusses systems of Bradford and Leeds and gives particulars of operating costs.

Westinghouse-Packard Trolley Bus. Recent Trolley Bus Developments, K. A. Simmon. Automotive Manufacturer, vol. 43, no. 7, Oct. 1921, pp. 15-18, 5 figs. Describes Westinghouse-Packard trolley bus, a truck chassis with electric motors in tandem furnishing power. Results of tests.

RAILWAY ELECTRIFICATION

Boston-Washington. Plan for Electrifying Sections of Eleven Railroads. Ry. Mech. Engr., vol. 95, no. 12, Dec. 1921, pp. 739-743, 9 figs. Superpower report provides for [illegible] of power supply in region between Boston and Washington.

Brazil. The Paulista Electrification, S. B. Cooper. Ry. & Locomotive Eng., vol. 34, no. 11, Nov. 1921, pp. 304-306, 3 figs. Discusses new line of Companhia Paulista de Estradas de Ferro, between Jundiahy and Campinas, Brazil. Baldwin-Westinghouse electric locomotives type 2-4-0+0-4-2 for passenger service and 0-6-0+0-6-0- for freight .

Chile. Chile Starts on Extensive Electrification Program. Elec. Ry. Jl., vol. 58, no. 23, Dec. 3, 1921, pp. 991-993, 5 figs. First zone of State Railways, comprising 144 miles, which includes Valparaiso-Santiago line, to be completely electrified at 3,000 volts d. c.

France. Electrification of French Railways and American Experience (L'Electrification des Chemins de fer Français et l'expérience Américaine), A.-R. Garnier. La Technique Moderne, vol. 13, nos. 4, 5, 7, and 8, Apr. May, July and Aug. 1921, pp. 167-173-, 209-217, 305-315 and 346-356, 19 figs. Apr.: Gives tabulation of efficiency of single and three-phase systems; cost of installation; American and Canadian lines; etc. May: Reviews French, Swiss, Italian, German and American electrification; power, substations and their equipment, motor generators, locomotives, etc. July: High and low-tension apparatus, direct control for fast trains, auxiliaries transmission systems, etc. Aug.: Practical results obtained in Europe and America; tables of power consumption etc. of various lines; further electrification projects by French roads. (Concluded.)

RAILWAY OPERATION

Automatic Train Control. An Automatic Mechanical Train Controller. Engineer, vol. 132, no. 3437, Nov. 11 1921, pp. 520-521. 4 figs. Details of device for automatical y giving warning in cab of locomotive of position of signals on line, and for simultaneously applying brakes.

Automatic Train Control, North Eastern Railway. Ry. Gaz., vo . 35, no. 21, Nov. 18, 1921, pp. 765-767, 5 figs. Describes system which has been in use for many years. and is applicable to engines and stock fitted with Westinghouse, Westinghouse and vacuum combined, or vacuum brakes alone.

The "Daniels" Automatic Train-Stop. Ry. Gaz., vol. 35, no. 19, Nov. 4, 1921, pp. 683-685, 5 figs. New, exclusively mechanical, train-stop, designed to give warning at distant signal and to cause a partial application of brakes, and at stop signals, should they be passed at "danger," to cause a further positive brake application, and to shut off steam. Apparatus provides for a distinct audible indication as a "clear" signal of either type is passed.

Lackawanna. Lackawanna Success the Result of Supervision, Charles W. Foss and James G. Lyne. Ry. Age, vol. 71, nos. 22 and 23, Nov. 26, and Dec. 3, 1921, pp. 1027-1032 and 1097-1102, 24 figs. Nov. 26: Notes on service, elimination of grades and curvature, locomotives, freight and passenger cars, and handling of coal. Dec. 3: Details of handling of coal and manifest freight.

Light Railways. On the Question of Operation of Light Railways, Working Rules and Regulations, F. Level. Bul. Int. Ry. Ass., vol. 3, no. 10, Oct. 1921, pp. 1471-1482. Summary of replies from 106 administrations to questions regarding classes of tickets, issuing, collecting, checking, etc.

Safety Appliances. On the Question of Safety Appliances on Light Railways, A. Bonnevie. Bul. Int. Ry. Assn., vol. 3, no. 10, Oct. 1921, pp. 1539-1588. Gives tabulation of lines in various countries and the length, gage, gradients, curve radii, maximum load, brakes, couplings, speeds, number of trains, track, signals, etc.

RAILWAY SHOPS

Operations and Apparatus. Railroad Shop Operations and Apparatus, Frank A. Stanley. Am. Mach., vol. 55, no. 23, Dec. 8, 1921, pp. 922-923, 9 figs. Describes "home-made" acetylene gas generator; cutting continuous threads on staybolts; systematic arrangement of tools.

RAILWAY SIGNALING

Liverpool Overhead Railway. The Re-Signaling at the Liverpool Overhead Railway. Engineer, vol. 132, no. 3436, Nov. 4, 1921, pp. 488-489, 3 figs. Signaling is arranged on a 2-min. service, but actually is based on interval between trains of 100 sec. Notes on overlaps; light signals; color-light signals; track transformers, relays, etc.; train stops; and emergency cross-over roads.

Track Circuits, A.C. Shunting Characteristics of the Relay in an A-C. Track Circuit Employed in Railroad Signaling, C. F. Estwick. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 12, Dec. 1921, pp. 919-925, 5 figs. Study of various characteristics of track circuit particularly in connection with shunting action

RAILWAY TRACK

Crossings. Railroad Crossings and Crossing Signs, R. S. Messenger. Elec. Ry. Jl., vol. 58, no. 17, Oct. 22, 1921, pp. 744-745. Suggests standardization to reduce accidents. (Abstract). Paper read before National Safety Council.

RAINFALL

[illegible] High Rates of Rainfall, Allen Hazen. [illegible] 1921, pp. 858-860, 6 figs. A probability-method study of data for Eastern and Middle Western States in Mor[illegible] and Meyer's "Elements of Hydrology".

[illegible]ATION

[illegible] in Florida. Eng. World, vol. [illegible] dragline operation over soft ground.

RECTIFIERS

Mercury-Vapor. Application of Glass Mercury Vapor Rectifiers of Medium Power (Les applications du redresseur a vapeur de nercure de moyenne puissance en verre), Maurice Leblanc. Revue Générale de l'Electricité, vol. 10, no. 21, Nov. 26, 1921, pp. 765-770, 12 figs. Discusses the field between the most powerful glass rectifiers and the least powerful metal rectifiers and endeavors to close this gap.

Mercury-Vapor. Mercury Vapor Rectifiers (Les redresseurs à vapeur de mercure), François Aubert. La Technique Moderne, vol. 13, no. 7, July 1921, pp. 289-298, 25 figs. Discusses importance of converting a.c. to d.c. principle, its properties, early types, difficulty of constructing them for large capacity, and examples of modern high capacity rectifiers.

REFRACTORIES

Research. Report of the Refractories Materials Committee. Gas World, vol. 75, no. 1943, Oct. 15, 1921, pp. 322-324 and (discussion) 324-325, 1 fig. Notes on jointing materials, including softening-point of mixtures of silica brick and clay firebrick, and mixtures of fireclay with fireclay grog; research.

REFRIGERATION

Total-Heat Diagram. Solving Refrigerating Problems by the Total Heat Diagram. Power, vol. 54, no. 22, Nov. 29, 1921, pp. 839-841, 3 figs. Describes use of Mollier diagram or total heat chart based on Goodenough's table of the properties of ammonia.

RELATIVITY

Einstein's Theory. Einstein and the Theory of Relativity, J. H. Jones. Engineer, vol. 132, nos. 3438, 3439 and 2440, Nov. 18, 25, and Dec. 2, 1921, pp. 529-530, 556-558 and 588-599, 2 figs. Nov. 18: The beginnings of relativity. Nov. 25: Distance between two points; time between two events. Dec. 2; Apparent contraction; composition of velocities; Fresnel's convention coefficient; mass and momentum, and mass and energy. Article deals only with Einstein's restricted theory.

RESERVOIRS

Groined-Arch. An English Groined Arch Service Reservoir. Eng. & Contracting, vol. 56, no. 24, Dec. 14, 1921, pp. 550-551, 2 figs. Reservoir of Birkenhead-Almen water supply covers area of 3. 6 acres, and holds 30,000,000 gal., total depth is 32 ft. of which 5 ft. is below ground level; roof consists of 217 concrete domes, each 30 ft. in diam., supported on 432 pillars built in concrete blocks. (Abstract). From Concrete & Constructional Eng.

Reinforced-Concrete. Reinforced Concrete Reservoir at Perty Amboy, New Jersey, George A. Johnson. Am. City, vol. 25, no. 6, Dec. 1921, pp. 451-455, 4 figs. Describes buildings of first 40,000,000-gal. unit of proposed 160,000,000 gal. water-distributing reservoir. It is 900 ft. long, at full water level, with width varying from 230 to 370 ft., and has water depth of 25 ft. Feature of reservoir is said to be design of bottom and top slabs.

ROADS

Impact Tests. Tests of Impact on Pavement by the Bureau of Public Roads, C. A. Hogentogler. Pub. Roads, vol. 4, no. 6, Oct. 1921, pp. 3-18, 10 figs. Results of tests on road slaps, for purpose of throwing light on behavior and resistance of various types of pavements when subjected to forces similar to those produced by heavy motor trucks.

See also Eng. News-Rec., vol. 87, no. 23, Dec. 8, 1921, pp. 944-947, 8 figs.

ROADS, BRICK

Rolled-Base. "Rolled-Base" Brick Roads in Ohio, A. T. Goldbeck and F. H. Jackson. Eng. & Contracting, vol. 56, no. 23, Dec. 7, 1921, pp. 528-529. Account of Inspection of number of brick roads of so-called "rolled-Base" type conducted by authors for purpose of obtaining information regarding their behavior under various traffic and subsoil conditions. Includes description of roads together with comments regarding methods of construction, soil drainage, and traffic conditions. (Abstract.) Public Roads, Nov. 1921.

ROLLING MILLS

Electrically Driven. Motoe Equipment for Main Drive of Rolling Mills. Electrician, vol. 87, no. 2270, Nov. 18, 1921, pp. 647-653. List of particulars of electrically-driven rolling mills.

The Future of the Electrically Driven Rolling Mill, L. Rothera. Electrician, vol. 87, no. 2270, Nov. 18, 1921, pp. 632-633. Discusses cost of production and electric drive, influence of power factor, and the chance for the gas engine with available-gas supplied from blast furnaces and coke ovens.

Motors, Size of. Factors which Influence the Size of Rolling Mill Drives, L. Rothera. English Elec. Jl., vol. 1, no. 7, July-October 1921, pp. 291-297,8 figs. Discusses power demand for rolling various sections, output rquired and methods of rolling, as factors in determining size of motor.

ROPE

Fibre. Ribre Rope (Cables de fibra). Ingenieria Internacional, vol. 6, no. 6, Dec. 1921, pp. 321-325, 7 figs. Discusses power transmission rope, single and multiple transmission systems, tensile strength, calculations, etc.

Manila. Results of Some Test of Manila Rope, Ambrose H. Stang and Lory R Strickenberg. U.S. Bur. of Standards Technologic Papers, no. 198, Sept. 15, 1921, 11 pp. Summary of results of tensile tests of 368 specimens of rope, all of which were 3-strand, regular lay manila rope having diameters from ½ in. to 4½ in. are given in tables and graphically. Gives formula for determining average breaking load as function of diameter of rope. Ropes showed continually varying modulus of elasticity and no well-defined proportional limit.

RUBBER

Aging. The Aging of Rubber. Andrew [illegible] A. Mar. Eng., vol. 25, no. 23, Dec. 7, 1921, pp. 1039-1042. [illegible] acceleration of oxidation; depolymerization; [illegible] aging.

Microsectioning. Recent Development in the Art of Rubber Microsectioning, Henry Green. Jl. Indus. & Eng. Chem., vol. 13, no. 12, Dec. 1921, pp. 1130-1132, 11 figs. Describes [illegible] method [illegible] freezing method. Paper read before Am. Chem. Soc.

Vulcanization. The Relation between Coefficient of Vulcanization and Mechanical Properties of Vulcanized Rubber, O. de Vries. Jl. Indus. & Eng. Chem. vol. 13, no. 12, Dec. 1921, pp. 1133-1134. Results of investigations showing that the natural accelerator or accelerators in rubber cause an increase in coefficient of vulcanization for fixed mechanical properties which amounts to about 0.5 for all types of quick-curing rubber, independent of their composition.

S

SAFETY

Inspection. Safety Inspectors and Inspections, John A. Dickinson. Am. Mach., vol. 55, no. 22, Dec. 1, 1921, pp. 887-869. Diffeernt types of inspection. Importance of standardizing safeguards. Advantages of helping inspectors.

SANITATION

Engineering Problems. Sanitary Engineering Problems and Progress. Eng. News-Rec., vol. 87, no. 22, Dec. 1, 1921. pp. 904-908. Abstracts of paper, reports and discussions at meeting of Am. Pub. Health Assn. and conference on sanitation problems held by Am. Soc. Civ. Engrs., dealing with stream pollution and sewage disposal, water supply and water purification, street cleaning and solid wastes disposal, and odors and their travel.

SCALES

Inspection and Maintenance. Inspection and Maintenance of Weighing Scales, Herbert T. Wade, Management Eng., vol. 1, no. 5, Nov. 1921, pp. 289-294, 10 figs. Describes scale-inspecting department of the Scovill Mfg. Co., Waterbury, Conn. Scale service organization.

Locomotive. Locomotive Weighing Plant of large Capacity, Carl C. Bailey. Ry. Mech. Engr., vol 95, no. 12, Dec. 1921, pp. 749-750, 3 figs. Heavy scale is housed in special building with equipment for determining all wheel loads at one time.

SCIENTIFIC MANAGEMENT

See Industrial Management; Taylor System.

SEMI-DIESEL ENGINES

Beardmore. Construction of Internal-Combustion Engines. Shipbldg. & Shipg. Rec., vol. 18, no. 22, Dec. 1, 1921, pp. 703 708, 9 figs. Describes the Beardmore semi-Diesel oil engines.

SEWER CONSTRUCTION

Soft-Ground Tunnels. Construction Systematized in Soft Ground Tunnel. Eng. News-Rec., vol. 87, no. 23, Dec. 8, 1921, pp. 940-942, 7 figs. Steel lines plates hold roof with shallow cover; pneumatic spades effective; concrete deposited through chutes driven through ground.

SEWERS

Inverted Siphons for. Inverted Siphons for Sewers. Eng. & Contracting, vol. 56, no. 24, Dec. 14, 1921, pp. 552-555. Outlines principles and practice relating to inverted siphons. (Abstract.) Committee report before Boston Soc. Civ. Engrs.

SHAPERS

Use in Production work. Production Shaping. Machy. (N.Y.), vol. 28, no. 4, Dec. 1921, pp. 272-276, 9 figs. Use of shapers in production work in machine-tool building plants.

SHIP PROPULSION, ELECTRIC

Merchant and War. Electric Propulsion of Ships, W. E. Thau. Advance Copy, Soc. of Naval Architects & Mar. Engrs., meeting Nov. 17-18, 1921, No. 4, 17 pp. 5 figs. Discusses propulsive equipment for merchant ships, turbine electric propulsive equipment, Diesel-electric equipment, and principal phases of electric propulsive equipment for war vessels.

SHIPS

Liners. England's Latest Type of Ocean Liner, The Scythia. Mar. Eng., vol. 26, no. 11, Nov. 1921, pp. 819-824, 15 figs., partly on supp. plates. Built by Vickers Ltd. Displacement 27,000 tons; 13,000 s.hp.; speed 17 knots; oil consumption 1,106 lb. per s. hp. Describes equipment and passenger accommodation.

SILICA BRICK

Manufacture and Use. Manufacture and Use of Silica Brick, Jefferson Middleton. Cem. Mill & Quarry, vol. 19, no. 9, Nov. 5, 1921, pp. 25-27. How material is ground and washed . Burning brick in circular down-draft kilns. Used for purposes where temperatures are high. (Abstract). Mineral Resources of U.S.

STANDARDIZATION

Germany. Industrial Standardization in Germany Auto Motive Industries, vol. 45, no. 23, Dec. 8, 1921, p. 1127. Discusses national standardization as developed in Germany under post-war conditions.

Industrial Standardization in Germany. P. G. Agnew. Jl. Am. Soc. Heating & Ventilating Engrs., vol. 27, no. 8, Nov. 1921, pp. 794-796. Describes advanced state of industrial standardization in Germany. 144 approved standards sheets have been issued and over 500 others have been developed. Notes on organization and methods of work.

Industrial. Industrial Standardization. Jl. Soc. Automotive Engrs., vol. 9, no. 6, Dec. 1921, pp. 359-435, 66 figs. A number of articles on standardization including standardization in Germany, S.A.E. standardization, automobile standardization in Great Britain, decreasing production costs through standardization, and reports of divisions to A.S.E. Standards Committee.

Inter-Works. Standardization and Assimilation, H. Varley. Eng. & Indus. Management, vol. 6, no. 20, Nov. 17, 1921, pp. 554-556. Writer advances plea for wider adoption of inter-works standardization and explains where and how it can be performed and applied.

STANDARDS

German N.D.I. Report. German Industry Committee on Standards (Normenausschuss der Deutschen Industrie). Betrieb, vol. 4, no. 1, Oct. 8, 1921, pp. 1-9, 8 figs. Proposals of the Board of Directors for blank hexagonal nuts, blank washers, low dimensions for drills and countersinks, diameters of core drills; sink-water traps with openings and with covers. Proposed standards for copper and brass.

German Industry Committee on Standards (Normenausschuss der Deutschen Industrie.) Betrieb, vol. 4, no. 2, Oct. 22, 1921, pp. 17-24, 9 figs. Proposed standards for offset and straight-arm hand cranks; brass; vector designations; permissible stresses in building material (mild steel and wood); terminology for cast iron, malleable iron, steel castings.

Importance of. Executives Should Foster Use of Standards. Herbert Chase. Automotive Industries, vol. 45, no. 23, Dec. 8, 1921, pp. 1101-1107, 2 figs. Proper use of standard specifications, fittings and dimensions tends to eliminate waste save time and cut expenses. Engineers know value of standards, but executives have, in general, failed to realize their importance and encourage their use.

STEAM-ELECTRIC PLANTS

Superpower System. Steam-Electric Central Stations Retained for the Superpower System, Arthur R. Wellwood. Power, vol. 54, no. 25, Dec. 20, 1921, pp. 969-972, 5 figs. Existing steam-electric stations retained represent 80 per cent of all such stations in Superpower Zone, and were chosen as result of detailed analysis and study based upon their 1919 performance. Operation of retained plants.

STEAM ENGINES

Exhaust. Simplification and Reduction of Operating Costs of Exhaust-Steam Engines by Simultaneous Utilization of Furnace Waste Heat (Vereinfachung und Betriebsverbillingung von Abdampfkraftanlagen durch gleichzeitige Ausnutzung von Ofenabwärme), Ernst Blau. Fördertechnik u. Frachsverkerh, vol. 14, no. 8, Apr. 15, 1921, pp. 88-90, 4 figs. Describes "Gefa" patented process for operation of exhaust-steam storage plants.

Heat Utilization. The Utilization of Heat in Steam Engines (Wärmeausnutzung bei Kraftmaschinen), K. Heilmann. Zeit. für Dampfkessel u. Maschinenbetrieb, vol. 44, no. 40, Oct. 7, 1921, pp. 315-319, 6 figs. Discusses relations between exhaust-steam utilization and power generation.

STEAM PIPES

Flow in. Machinery and Pipe Arrangement Calculations—XIII, C. C. Pounder. Mech. World, vol. 70, no. 1819, Nov. 11, 1921, pp. 386-388, 1 fig. Continues discussion of safety-valve springs and gives examples and calculations; also discusses weight flow of steam through pipes.

Steam Flow in Pipes, F. M. Van Deventer. Power Plant Eng., vol. 25, no. 22, Nov. 25, 1921, pp. 1096-1098, 1 fig. Steam flow chart for superheated steam and table of pipe sizes.

STEAM POWER PLANTS

Heat-Balance Systems. Heat Balance in Steam Power Plants. Mech. Eng., vol. 43, no. 12, Dec. 1921, pp. 790-796 and 825, 8 figs. Particulars of systems employed in three large modern stations, namely, Delaware Station of Philadelphia Elec. Co., by E. L. Hopping; Hell Gate Station, by J. H. Lawrence and W. M. Keenan; and Colfax Station, by C. W. E. Clarke.

Sanitarium. Steam for Battle Creek Sanitarium. Power Plant Eng., vol. 25, no. 23, Dec. 1921, pp. 1131—1138, 14 figs. Mechanical coal and ash handling automatically controlled underfeed stokers, special water treatment and graphic record system.

Critical Speeds. Simplified Appromixations of Critical Speeds, G. Arrowfmith Engineering, vol. 112, no. 2917, Nov. 25, 1921, pp. 717-720, 8 figs. Points oun that critical speeds can in very many cases be obtained without resource to tedious graphical constructions of bending moment and deflection dirgrrms.

Efficiency Calculations. Turbine Efficiency Calculations, Paul F. Christopher. Power Plant Eng., vol. 25, no. 21, Nov. 1, 1921, pp. 1039-1042, 3 figs. Use of heat-enthropy diagram in calculation of efficiency; estimating power load to meet demands for exhaust steam.

Steam Consumption. A Simple Method of Finding Steam Consumption of Small Turbines. Power, vol. 54, no. 23, Dec. 6, 1921, pp. 895-896, 3 figs. Presents curves for determining water-rate factor for any turbine at any load.

STEEL

Alloy. [illegible]

Carburizing. Present Theories of Carburizing Steel, H. B. Knowlton. Forging & Heat Treating, vol. 7, no. 11, Nov. 1921, pp. 543-548, 14 figs. Application of theories to commercial problems: effect of different temperatures on per cent and distribution of carbon in the case.

Chrome. [illegible]

Composition and Properties. Principal Steels and Their Characteristics and Uses (Les principaux aciers de construction, leur caractéristiques et leurs emplois), P. Dejean. La Houille Blanche, vol. 20, no. 55-56, July-August 1921, pp. 149-151, 3 figs. Gives tables of composition and properties. Discusses carbon steels, mild steels, cementation steels, corrosion resistant steels, etc., and their uses.

Ingots, Defects in. Defects in Ingots and Methods for Remedying Them (Les défauts des lingots et les méthodes pour y remédier), Sigma. La Métallurgie, vol. 53, no 47, Nov. 24, 1921, pp. 2185-2186. Summarizes results of investigations by L. Guillet, including piping, cracks, segregation, etc.

Low-Carbon, Strain Lines in. Strain Lines in Low Carbon Steel, A. Fry. Iron Age, vol. 108, no. 22, Dec. 1, 1921, pp. 1401-1402, 10 figs. New German etching method revealing effects on metal which has been stressed. Origin and character of lines. Translated from Stahl u. Eisen, Aug. 11, 1921.

Magnetic Analysis. Magnetic Analysis of Steel, R. L. Sanford. Am. Mach., vol. 55, no. 21, Nov. 24, 1921, pp. 836-839, 7 figs. Uses of electric current for inspection. Apparatus and method of operation; relation of magnetic to mechanical properties of steel. Advantages and difficulties.

Stainless. Stainless Steel and Its Engineering Applications. Mech. World, vol. 70, no. 1817, Oct. 28, 1921, pp. 346-348, 3 figs. Describes tests made with stainless-steel turbine blades at works of Th. Firth & Sons, Sheffield, showing that the blades remained absolutely unaffected. Also discusses manufacture of stainless steel and its properties.

STEEL, HIGH-SPEED

Heat Treatment. Proper Heat Treatment for High Speed Steel, J. L. Thorne. Can. Machy , vol. 26, no. 19, Nov. 10, 1921, pp. 36-37 and 53.Gives instances of improper heat treatment, object of high temperature furnace; quenching the tool; heating cutting edges.

Tool Steel. Action of Internal Stress on Tool Steel, C. Neil Greenwood. Forging & Heat Treating, vol. 7, no. 11, Nov. 1921, pp. 560-563. Discusses origins of internal stresses in pure metals and alloys, due to cold working and to suppression of phase changes by rapid cooling; volume changes taking place during heating and cooling. (Abstract). Paper read at joint meeting of Faraday Soc. with other institutions.

STEEL INDUSTRY

Research in. Research in the Steel Industry ,John A. Mathews. Min. & Metallurgy, no. 180, Dec. 1921, pp. 11-13. Discusses ways in which research department of steel company may function in order to contribute to success.

[illegible] WORKS

English. Methods in a Modern Stee Works. Eng. Production, vol. 3, no. 62, [illegible] plant and equipment of Thos. Firth [illegible]

STOKERS

Automatic. Use of Automatic Stoking in Industries (L'Emploi des foyers automatiques dans l'industrie), H. Drouot and F. Verdeaux. La Technique Moderne, vol. 13, nos. 8 and 9, Aug. and Sept. 1921, pp. 337-343 and 376-383, 37 figs. Aug: Discusses the various arrangements of grates and stokers, including those by Wackernie, Forney, Leach, Wilkinson, Godillot, Grieve, Babcock & Wilcox, Hotchkiss, Coxe, Ill. Stoker Co.; Green's ash conveyor. Sept. Discusses underfeed stokers and describes apparatus by Donneley, Jones, Riley and Combustion Eng. Corp.

STORAGE BATTERIES

Alkaline. Alkaline Accumulators, Albert Clarke. Beama, vol. 9, no. 5, No. 1921, pp. 446-450, 4 figs. Summarizes construction, production, average performances of, and recent developments of various types.

Hydraulic. Some Experience with Hydraulic Accumulator, J. A. McGillivray. Power House, vol. 14, no. 21, Nov. 5, 1921, pp. 24-27, 3 figs. Discusses some of the difficulties encountered when hydraulic system is called on to supply a heavy overload, and methods adopted to keep plant running.

STREAM POLLUTION

Dilution Factor. The Dilution Factor, Langdon Pearse. Eng. & Contracting, vol. 56, no. 24, Dec. 14, 1921, p. 546. Discusses bases for dilution factor, and gives data drawn from experience of Sanitary District of Chicago. Describes effect of sewage on fish life. (Abstract) Paper before Am. Soc. Civ. Engrs.

STREET RAILWAYS

Track Reconstruction. Reconstruction of Toronto Street Railway System on Large Scale. Contract Rec., vol. 35, no. 47, Nov 23, 1921, pp. 1009-1014, 15 figs. Track rehabilitation carried out by methods designed primarily for speed. Notes on steam-shovel grading, rapid pavement breaking and batch-transfer method of concreting.

STRESSES

Analysis of Internal State of. The Geometry of Progress in Structural Engineering or Euclidian Principles Applied to Stress Analysis and Volunetric. Measurement of Mechanical Intelligence, C. A. P. Turner. Cem. & Eng. News, vol. 33, no. 12, Dec. 1921, pp. 19-25, 3 figs. Writer claims that during past 20 years the structural engineer has advanced little in precise knowledge of internal states of stress in elastic materials of constructing upon which their strength or resistance depends. Refers to idio-syncracies of building code provisions for shear, and inconsistencies of research work, etc., which point to backward rather than forward trend of theoretical progress.

STRUCTURAL STEEL

Joists. Using Steel Lumber in Building, Thomas J. Foster. Iron Trade Rev., vol. 69, no. 21, Nov. 24, 1921, pp. 1350-1352 and 1359, 5 figs. Light steel I-joists, with cross bridging, metal lath and steel accessories have been developed to take place of wood. Light weight and fire-resisting properties are chief advantages. (Abstract). Paper read before Am. Iron & Steel Inst.

SUBSTATIONS

Automatic Converter. Canadian Automatic Converter Sub-Station. Engineering, vol. 112, no. 2918, Dec. 2, 1921, pp. 747-750, 8 figs. Station of Toronto hydro-electric system recently completed is of Westinghouse type, and laid out for 1000-kw, capacity, with provision for extension. Energy is received from high-level sub-station through 13,200-volt, 25-cycle, three-phase overhead transmission line through 300-amp. oil circuit breaker. Details of main converter transforners, rotary transformers, rotary converter, switchboard, etc. Details of operation.

SUPERHEATED STEAM

Industrial Heating. Superheated Steam for Heating Only. Power Plant Eng., vol. 25, no. 24, Dec. 15, 1921, pp. 1199-1200, 1 fig. Describes 3,000 hp. boiler plant of Lever Bros. Co. East Cambridge, Mass.; generates high pressure steam for industrial purposes only.

SURVEYING

Cadastral Resurveys. A Review of Important Developments in the Science of Cadastral Resurveys as Executed by the United States Government, with Ethical Discussion Thereof, Howard R. Farnsworth. Proc. A. Soc. Civ. Engrs., vol. 47, no. 9, Nov. 1921, pp. 405-442, 13 figs. Notes on improvements in field; identification and restoration of corners; identification of alienated lands.

T

TAR

DISTILLATION OF. Tar Distillation and Sulphate of Ammonia Manufacture. Gas World, vol. 75, no. 1943, Oct. 15, 1921, pp. 343-345. Describes different processes of tar dehydration and distillation and different sulphate of ammonia plants.

TAYLOR SYSTEM

CIVIL ENGINEERING. Organization in Public Building Work (L'organisation des travaux publics), C. Andreae. Bulletin Technique de la Suisse Romande, vol. 47, no. 24, Nov. 26, 1921, pp. 277-281, 2 figs. Discusses Taylor system and scientific management for civil engineering as against mechanical, in factories, etc.

TELEGRAPHY

INDUCTIVE INTERFERENCE. Inductive Interference in Telegraph and Telephone Circuits (Perturbazioni induttive sui circuiti Telegrafaci e Telefonici) G. Di Pirro. Telegrafi e Telefoni, vol. 2, no. 4, July-August 1921, pp. 151-170, 27 figs. Discusses electrostatic and electromagnetic induction, kinds of interference and remedial measures, interferences caused by d.c. traction current, etc.

TELEPHONY

GH-FREQUENCY. High Frequency Telephony Along Power Lines (La telefonia ad al ta frequenza sulle condutture industriali coi sistemi "Arturo Perego"), G. Giorgi. L'Elettrotecnica, vol. 8, no. 31, Nov. 15, 1921, pp. 682-683, 2 figs. Describes the Arturo Perego system of wired wireless, antenna parallel to transmission line.

EPEATERS. Three-Electrode-Lamp Repeaters in Telephony (Ripetizione Telefonia amplificata con la lampada a tre elettrodi, G. Marchesi. Telegrafi e Telefoni, vol. 2, no. 4, July-August 1921, pp. 170-177, 8 figs. Discusses single repeater or Edison system, two repeater single current or Richard system, and the four wire double circuit system. (Concluded)

TERMINALS, RAILWAY

EIGHT. New Freight Terminal for the N.Y.N.H. &. H.R.R. in Providence, R.I. Ry. Rev. vol. 69, no. 22, Nov. 26, 1921, pp. 707-711, 9 figs. Has approximate standing capacity of 4,000 cars, with yard trackage of 55 miles.

ASSENGER. On the Question of Terminal Stations for Passengers, A. S. Baldwin. Bul. Int. Ry. Assn. vol. 3, no. 10, Oct. 1921, pp. 1483-1526, 14 figs. Discusses arrangements for reducing movements of locomotives and empty rolling stock at passenger terminals; types of terminals: stub,through, loop and combinations; their capacity, track curvatures, etc. Appendix.

TEXTILE MILLS

ECTRICITY IN. Electricity in Textile Mills. Elec. Jl. vol. 18, no. 11, Nov. 1921, pp. 486-517, 53 figs. The Central Station and the Textile Mill by F. S. Root; Modernized Plant of Prudential Worsted Co. by J. B. Parks; The Textile Industry in the South John Gelzer; The Design of Induction Motors for Textile Service, O. C. Schoenfeld; Individual Motor Drive for Spinning and Twister Frames, George Wrigley; Motors for Textile Finishing Plants, Warren B. Lewis; Central Station Power for Textile Mills, John H. Fox; Adjustable Speed Motors and Control in Finishing Plants, C. W. Babcock, Silk Throwing and Electric Drive, C. T. Guilford; Day and Night Lighting in Textile Mills, Samuel G. Hibben.

TIDAL POWER

STALLATIONS. Tidal Power Installations (Installations marémotrices), André Defour. L'Electricien vol. 52, no. 1287, Nov. 1, 1921, pp. 488-494, 9 figs. Describes French plant at Rotheneuf, Ille-et-Vilaine, and gives cost calculation per hp. for the different types of equipment.

ILIZATION. Using Tidal Energy (Sur l'utilisation de l'énergie des marées), A De Rouville. Revue Générale de l'Electricité, vol. 10, no. 18, Nov. 5, 1921, pp. 627-631. Reviews the question from technical and economical standpoints; favors solution by reservoirs. Note on same subject by Georges Claude; pp. 631-632.

TIMBER

STIMATING. The Jonson Absolute Form Quotient: How it is used in Timber Estimating, H. R. Wickenden. Jl. of Forestry, vol. 19, no. 6, Oct. 1921, pp. 584-593. Volume and taper of trees is determined by the ratio between two diameters on the tree. Has been in successful use in Scandinavia for ten years.

TIME STUDY

ECONOMY OF HUMAN EFFORT. Economy and Human Effort in Industry, E. Farmer. Eng. & Indus.. Management, vol 6, no. 19, Nov. 10, 1921, pp. 535-537. Deals with alternative choices, namely, unreconcilable hostility to study; approval of its present form; and scientific inquiry into its possibilities. (Abstract). Paper read before British Assn.

METALLURGICAL ANALYSIS. Time Studies in Metallurgical Analysis, W. F. Dietrich. Min. & Sci. Press, vol. 123, no. 21, Nov. 19, 1921, pp. 708-710. Preliminary report on application of detailed time studies to instruction in metallurgical analysis in department of mining and metallurgy of Stanford University.

TOOL MAKING

RAW MATERIAL FOR. The Economical Size and Accurate Cost of Raw Material used in Tool Manufacture. Machinery (Lond.), vol. 19, no. 476, Nov. 10, 1921, pp. 155-159. Discusses correct diameter and length of blank, its weight, and cost per lb. of material. Gives table of weights for high-speed steels.

TRACTORS

MACHINING METHODS. Production Methods in a Tractor Works. Eng. Production, vol. 3, nos. 57 and 58, Nov. 3 and 10, 1921, pp. 421-425, and 443-446, 22 figs. Details and equipment of factory recently laid out by Wallace (Glasgow), Ltd., for manufacture of the Glasgow tractor. Details of tractor and machining process.

TRANSFORMERS

220,000-VOLT. Features of 220,000-Volt Transformers Available for First Time, Walter M. Dann. Elec. World, vol. 78, no. 22, Nov. 26, 1921, pp. 1063-1066, 9 figs. Rates at 16,667 kva. each, the Pacific Gas & Electric transformers constitute largest 220,000-volt units built to date; unusual coil arrangements, insulation and departure in ventilation make them of particular interest.

TRANSPORTATION

FACTORY. The Analysis and Control of Factory Transportation, F. A. Pope. Factory, vol. 27, no. 6, Dec. 1921, pp. 747-751, 6 figs. Describes plan providing both for internal transportation service and that of road trucks in outside work.

TUNNELS

DRIVING FLOOD-PROTECTION. Driving a 20,000 Sec. Ft. Flood Protection Tunnel. Eng. News-Rec., vol. 87, no. 22, Dec. 1, 1921, pp. 882-886, 7 figs. Turkey Creek diversion works at Kansas City includes 28 by 28-ft. tunnel through bedrock requiring grade change. Shovels are driven. Machine-mixed concrete placed by air.

LINING RAILWAY. Lining Railway Tunnels Under Traffic. Contract Rec., vol. 35, no. 49, Dec. 7, 1921, pp. 1066-1071. Various schemes used by several railway companies are described. Pneumatic concreting generally adopted although hand methods are used for short tunnels. (Abstract.) Committee report before Am. Ry. Bridge & Building Assn.

WATER-BEARING STRATA, THROUGH. Method of Constructing 8 Ft. Tunnel Through Water-Bearing Strata, R. F. Baker. Eng. & Contracting, vol. 56, no. 22, Nov. 30, 1921, pp. 518-519. Describes construction of tunnel by which aqueduct of Birkenhead Corporation passes under River Dee at point nearly ¾ mile below Hawarden swing bridge on Great Central Ry. Notes on tidal influence, method of excavating, rate of tunneling, etc. (Abstract.) Paper read before Liverpool Eng. Soc.

VOCATIONAL TRAINING

GERMANY. Industrial Training and Vocational Guidance, M. Morley. Eng. & Indus. Management, vol. 6, no. 20, Nov. 17, 1921, pp. 568-569. Outlines manner in which there are being developed in Germany as basic step towards decasualization. Most interesting of German plans is said to be the organized direction of workers from overcrowded or decaying industries to industries where their services are in demand.

W

FRENCH AND AMERICAN METHODS. Modern Theory of Salary (La théorie du salaire moderne), F. Bayle. La Technique Moderne, vol. 13, no. 5, May 1921, pp. 218-220. Discusses American and French methods and how they are arrived at.

REDUCTION, EFFECT OF. Cutting Wages the Sure Way to Retard Business Resumption, E. W. Hulet. Am. Mach., vol. 55, no. 23, Dec. 8, 1921, pp. 930-931. Study of business conditions for forty years. It is claimed that careful management makes high wages better for all.

Systems, Comparison of. Time, Piece-Rate and Premium Wage Systems (Zeitlohn, Stücklohn und Prämiensystem), H. Frydrychowics. Schiffbau, vol. 23, nos. 4-5, Oct. 26-Nov. 2, 1921, pp. 105-110, 3 figs. Discusses advantages and disadvantages of different systems in shipyards and recommends a new system.

WASTE UTILIZATION

Western Electric Co.'s Practice. More Dollars from Salvaged Material. Factory, vol. 27, no. 6, Dec. 1921, pp. 766-767, 3 figs. Describes how Western Elec. Co. saves $60,000 a year by changing its waste into by-products.

WASTES

Industrial, Salvaging. Salvaging Industrial Wastes, J. A. Smith. Mech. Eng., vol. 43, no. 12, Dec. 1921, pp. 797-798. Notes on salvage work in metal wastes and in maintenance and repairs.

WATER GAS

Blue. Investigating into the Manufacture of Blue Water Gas. Gas World, vol. 75, no. 1943, Oct. 15, 1921, pp. 321-322. Sixth report of Gas Investigation Committee discussing investigation of the manufacture in an outside generator; Uddington tests and lim ts of steaming; methods of diminishing heat losses; etc.

WATER METERS

Standardization. The Standardization of Water Meters — Disk Type, R. K. Blanchard. Jl. Am. Water Works Assn., vol. 8, no. 6, Nov. 1921, pp. 637-643, 1 fig. Discusses standard specifications for disk meters. Notes on demand for uniform overall length of meters; uniform length and design of couplings; uniform threads on spuds of meters; standard tests and capacities for disk meters; standard flanges.

WATER POLLUTION

Protection from. Protecting Water Supplies from Pollution, Allen Hazen. Fire & Water Eng., vol. 70, no. 23, Dec. 7, 1921, pp. 1049-1050, 1064 and 1076-1077. Principal methods of guarding water supplies from injurious contamination. Importance of filtration and chlorination.

WATER PURIFICATION

Colloidal Chemistry and. Some Notes on Colloidal Chemistry and Water Purification, Milton F. Stein. Jl. Am. Water Works Assn., vol. 8, no. 6, Nov. 1921, pp. 571-582. Notes on reactions in distilled and turbid water; practical measure of turbidity; effect of excess of alkali on coagulation; color and coagulation; color removal; test for color and tannins in water.

WATER TREATMENT

Chlorination. Tastes and Odors from Chlorination, Walter A. Sperry and Lloyd C. Billings. Jl. Am. Water Works Assn., vol. 8, no. 6, Nov. 1921, pp. 603-615, 3 figs. Where plant design is not well adapted for chlorinating, tastes are likely to be result of improper feeding. Some method of controlling chlorine feed is shown to be necessary. The chlorine absorption method, as outlined by Wolman and Enslow, is said to be consistent, accurate, and practicable.

WATT-HOUR METERS

Induction. Induction Watt-hour Meters, C. S. Darling. Beama, vol. 9, no. 5, Nov. 1921, pp. 459-466, 3 figs. Watt-hour meter gives at every instant a reading which is the summing up or integration of kw-hr. consumed.

WELDING

Metallography Applied to. Principles of Metallography as Applied to the Industry of Welding, W. H. Ludington. Jl. Eng. Inst. Can., vol. 4, no. 12, Dec. 1921, pp. 611-615, 5 figs. Outline of principles of metallography as applied to electric arc, thermit and oxy-acetylene welding.

See also Electric Welding; Fusion Welding; Oxy-Acetylene Welding.

WIRE ROPE

Fracture. The Fracture of Wire in Steel Ropes, E. M. Horsburgh. Engineering, vol. 112, no. 2916, Nov. 18, 1921, pp. 707-711, 13 figs. Fundamental principles are discussed, and attempt is made to deal with some problems in steel ropes in which general agreement has not yet been reached. Results of some of writer's experimental observations on wire ropes. Paper read before British Assn.

WOOD PRESERVATION

Car Sills, etc. The Preservative Treatment of Car Lumber, H. S. Sackett. Ry. Age, vol. 71, no. 23, Dec. 3, 1921, pp. 1079-1080, 3 figs. Discusses advantages of creosoting, decking, roofing, car sills, etc., and advocates extension of this practice.

Preservative Solution. Wood Preservative Which Makes Putrescible Matter Stable, Strengthens Timber, Making It Fire Resistant, F. G. Zinsser. Coal Age, vol. 20, no. 20, Nov. 17, 1921, pp. 793-796, 2 figs. Consists of oxides of copper and of zinc, ammonia and carbolic acid; solution of copper oxide in ammonia dissolves albumin, cellulose and pectines, making new bodies which cement wood and render inconstant substances stable.

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A

ACCIDENTS

INDUSTRIAL. The Prediction Cost of Industrial Accidents, Sanford DeHart. Am. Mach., vol. 56, no. 1, Jan. 5, 1922, pp. [illegible] figs. [illegible] on cost of accidents. Instances of reduction in [illegible] and monetary losses. Examples of simple but efficacious safety methods and appliances.

ACCOUNTING

MUNICIPAL UTILITIES. Standard Accounting for Municipally Owned Public Utilities, [illegible]. Elec. World, vol. [illegible], no. 1, Jan. 1, 1922, pp. [illegible]. States that [illegible] reports or statements of [illegible] until there is an adequate basis of comparison [illegible]. No such basis exists today. Discusses possibility of [illegible], standardizing of statements, etc.

POWER PLANTS. Power-Plant Accounts—XVI, [illegible]. Power, vol. 54, no. 26, Dec. 27, 1921, pp. 1013-1015, 2 figs. General scheme of accounts. (Concluded).

AIR COMPRESSORS

DISPLACEMENT, CODE FOR. Code for Displacement Compressors and Blowers. Mech. Eng., vol. 44, no. 1, Jan. 1922, pp. 15-18 and 70. Preliminary draft of fifth in series of 19 codes in course of preparation by A.S.M.E. [illegible] power tests codes.

MARINE DIESEL ENGINES. Design of Air Compressors for Marine Engines, David Bruce. Motorship, vol. 7, no. 1, Jan. 1922, pp. 22-24, 11 figs. Discusses compressing and cooling, single-stage and multiple-stage, compressor capacity, spring loads on compressor valves, etc.

AIRCRAFT

BRITISH. Modern British Aircraft. Flight, vol. 13, no. 45, Nov. 10, 1921, pp. 726-740, 36 figs. Deals with all the British firms at present engaged in airplane and seaplane construction.

AIRPLANE ENGINES

BRITISH. Modern British Engines. Flight, vol. 13, no. 46, Nov. 17, 1921, pp. 750-757, 21 figs. Describes all the British aero engines being manufactured at present.

REQUIREMENTS. The Aeroplane Engine, P. E. Biggar. Eng. Inst. Can. Jl., vol. 5, no. 1, Jan. 1922, pp. 15-21, 8 figs. Requirements of aircraft propulsion and their effect on engine design.

AIRPLANES

AEROFOILS. Aerodynamic Characteristics of Aerofoils—II. Nat. Advisory Committee for Aeronautics report no. 124, 1921, pp. 89-140, 165 figs. Collection of data on aerofoils made from reports of number of leading aerodynamic laboratories of United States and Europe and presented in a uniform series of charts and tables suitable for use of designing engineers and purpose of general reference. Continuation of Report no. 93.

Developments in Aircraft Design by the Use of Slotted Wings, F. Handley Page. Flight, vol. 13, nos. 51 and 52, Dec. 22 and 29, 1921, pp. 844-846 and 860-861, 17 figs. Deals with applications of slotted aerofoils. Results of tests.

COMMERCIAL OPERATION. Commercial Operation of Airplanes, L. B. Lent. Mech. Eng., vol. 44, no. 1, Jan. 1922, pp. [illegible]. Analyses of record of Air Mail Service of U. S. Post Office Dept. for year ending Sept. 30, 1921. Author points out possible improvements, most important being use of efficient commercial planes equipped with thoroughly reliable power plant. Total operating cost, it is claimed, should not exceed 70 cents per plane-mile for single-engine planes of not over 400 hp.

PRESSURE DISTRIBUTION OVER TAIL SURFACES. The Pressure Distribution over the Horizontal Tail Surfaces of an Airplane—I. Nat. Advisory Committee for Aeronautics report no. 118, 1921, 86 pp., 264 figs. Account of investigation to determine pressure distribution over two horizontal tail surfaces in uniform free flight.

The Pressure Distribution over the Horizontal Tail Surfaces of an Airplane—II. Nat. Advisory Committee for Aeronautics report no. 119, 1921, 40 pp., 85 figs. Shows that results obtained upon models [illegible] can be used to accurately predict loads upon full-sized tails and also to find distribution of load when large elevator angles are used.

AIRSHIPS

MOORING MASTS. A Portable Airship Mooring Mast. Aviation, vol. 11, no. 26, Dec. 26, 1921, p. 732, 1 fig. Describes U. S. Army Air Service mast consisting of four sections of 18 ft. each, capable of mooring ships up to 1,200,000 cu. ft. capacity.

ALLOYS

FUSIBLE. Fusible Alloys (Les Alliages fusibles), Sigma. La Métallurgie, vol. 53, no. 46, Nov. 17, 1921, pp. 2145-2147. Gives list of compositions for anti-friction metals, solders and other alloys.
[illegible]

ALUMINUM ALLOYS

ALUMINUM-IRON, ETC. Aluminum Alloys (Note complémentaire sur les alliages d'aluminium), Léon Guillet. Revue de Métallurgie, vol. 18, no. 10, Oct. 1921, pp. 681-684, 4 figs. Deals with aluminum-iron, aluminum-chromium, aluminum manganese, and aluminum-cerium.

MECHANICAL PROPERTIES. Aluminum and its Alloys—IV, F. A. Livermore. Metal Industry (Lond.), vol. 19, no. 22, Nov. 25, 1921, pp. 420-421 and 422, 1 fig. Alloys of aluminum and copper, and aluminum and zinc, and their mechanical properties and application.

MELTING. Aluminum and Its Alloys—V, Frank A. Livermore. Metal Industry (Lond.), vol. 19, no. 25, Dec. 16, 1921, pp. 496-500, 7 figs. Deals with difficulties in melting and discusses the question of pyrometric control.

AMMONIA

SYNTHESIS. The Claude Synthetic Ammonia Process, Nov. 26, 1921, pp. 665-666 and (discussion) 666-668, J. H. West. Chem. Age (Lond.), vol. 5, no. 128. Discusses catalyst vessels, catalyst material, removal of ammonia from catalyst tubes, cheap hydrogen, and industrial uses of synthetic ammonia.

ANEMOMETERS

TESTING. The Testing of Anemometers. James Cooper. Trans. Instn. Min. Engrs., vol. 62, Part 1, Nov. 1921, pp. 90-99, 9 figs. Discusses results of tests showing that anemometric measurements are unreliable, especially at the working-faces where exact knowledge is necessary. See also Min. Inst. of Scotland Trans., vol. 42, Part 2, 1921-1922, pp. 44-53, 9 figs.

APPRENTICES, TRAINING OF

PRESENT SCOPE, U. S. The Training of Workers in manufacture, J. V. L. Morris. Am. Mach., vol. 56, no. 3, Jan. 19, 1922, pp. 85-86. Present scope of apprenticeship in United States. Number of apprentices in various industries. Importance of apprentices in metalworking field.

ASH HANDLING

POWER PLANTS. Ash Handling in Large Generating Stations, L. R. Lee. Power, vol. 55, no. 3, Jan 17, 1922, pp. 86-90, 6 figs. Deals with handling and disposition of furnace ash, describes several designs of ashpits and points out merits or demerits of each. Describes different methods of ash disposal and provisions that must be made in case there is a failure in operation of ash-disposal system employed.

AUTOGENOUS WELDING

PIPE. Autogenous Pipe Welding, H. B. Iglehart, Welding Engr., vol. 6, no. 11, Nov. 1921, pp. 21-24, 16 figs. Describes tests on welded pipe construction and shows advantages of welded joints.

AUTOMOBILE ENGINES

DETONATION, MEASURING. Methods of Measuring Detonation in Engines, Thomas Midgley, Jr. and T. A. Boyd. Soc. Automotive Engrs. Jl., vol. 10, no. 1, Jan. 1922, pp. 7-11, 4 figs. Discusses various methods employed to measure detonation or fuel knock, such as the listening indicator, temperature and pouncing-pin, and describes latter method.

AUTOMOBILE FUELS

CALORIFIC VALUES. Royal Aircraft Establishments Reports, Nos. H. G. 410 and H. 861. Instn. Petroleum Technologists Jl., vol. 7, no. 28, Oct. 1921, pp. 339-351, 5 figs. Methods of determining calorific values of certain unsaturated hydrocarbons; and calorific values of petrols and of petrol fractions.

SENSIBLE FUELS. Total Sensible Heats of Engine Fuels and Their Mixtures with Air, Robert E. Wilson and Daniel P. Barnard, Soc. Automotive Engrs., Jl., vol. 10, no 1, Jan. 1922, pp. 65-68, 5 figs. Describes methods used by research laboratory of Mass. Inst. of Technology in determining total sensible heat content of Socony gasoline and kerosene and their mixtures with air at temperatures up to 500 deg. cent.

AUTOMOBILES

FRONT AXLES, MACHINING. Front Axles and Steering Knuckles, Fred H. Colvin. Am. Mach., vol. 55, no. 25, Dec. 22, 1921, pp. 1011-1013, 10 figs. Machining operations of Peerless axle. Spring actuated drilling fixtures which are quickly handled. Holding long, work for milling. Automatic lathe work on steering knuckles.

GEAR BOXES. Notes on Motor Car Gear-Boxes, H. F. L. Orcutt. Engineering, vol. 112, nos. 2920, 2921 and 2922, Dec. 16, 23 and 30, 1921, pp. 830-831, 870-872 and 897-899, 8 figs. In writer's opinion, based on over 10 years' experiences, gear boxes, generally speaking, are not well designed and are badly made. Discusses defects in design, workmanship and material, and summarizes gear-tooth requirements. Paper read before Instn. Automobile Engrs. (British.)

PAINTING AND VARNISHING. Manufacture and Application of Automobile Varnishes and Paints, L. Valentine Pulsifer. Soc. Automotive Engrs., Jl., vol. 10, no. 1, Jan. 1922, pp. 12-16. Specifies five basic materials necessary in automobile painting. Engineering systems of application and methods of application including drying and surfacing. Care of finish.

ROLLS-ROYCE WORKS. Rolls-Royce Methods. Eng. Production, vol. 3, nos. 63, 64 and 65, Dec. 15, 22 and 29, 1921, pp. 565-569, 580-596 and 613-618, 44 figs. [illegible] production methods.

SERVICE METHODS. Automotive Service Methods and Equipment Howard Campbell. Am. Mach., vol 55, no. 26, Dec. 29, 1921 pp. 1026-1028, 10 figs., and [illegible] 8 figs. Servicing the Rolls-Royce. [illegible] truck service methods and tools Servicing the Mack truck. Operations in a New York taxicab station.

B

BEAMS

[illegible] Beams of the Grey Type at the Differ-[illegible] à larges ailes du type Grey, aux [illegible] J. Audigé, Le Génie Civil, vol. 79, no. [illegible] Grey profiles; [illegible] flange beams.

CONTINUOUS. Calculation of Continuous Beams (Le calcul des portiques continus), L. Descans. Le Génie Civil, vol. 79, nos. 21 and 22, Nov. 19 and 26, 1921, pp. 439-443, and 461-464, 12 figs. Nov. 19: Discusses characteristics of continuous beams, calculation of loads, etc. Nov. 26: Analytical formulas.

DEFLECTION. Deflections of Beams by the Conjugate Beam Method, H. M. Westergaard. Jl. Western Soc. of Engrs., vol. 26, no. 11, Nov. 1921, pp. 369-396, 28 figs. Discusses standard methods, statically determinate beams, and statically indeterminate beams.

BELTING

LEATHER. Problems In Connection with Leather Belting, J. Edgar Rhoads. Can. Machy., vol. 26, no. 25, Dec. 22, 1921, pp. 24-25. Use of roller and ball bearings; common causes of trouble; humidity and its effect.

RECLAIMED LEATHER. Reclaimed Leather Belting. Machy. (N.Y.), vol. 28, no 5, Jan. 1922, pp. 363-365, 6 figs. Use of salvaged leather belts reinforced with woven cotton fabric. Processes employed by Syracuse Belting Co., in manufacture of reclaimed belting.

BENDING MACHINES

CUP-LEATHER SLEEVE FRICTION. Friction of cup-Leather Sleeves, Eugen Irlon. Mech. Eng., vol. 44, no. 1, Jan, 1922, pp. 59-60, 2 figs. Presents data of tests of friction carried out in a 75-ton hydraulic bending machine water-driven by a three-piston electric pump. Translated from Zeit. des Vereines deutscher Ingenieure, vol. 65, no. 39, Sept. 24, 1921, pp. 1016-1017.

BITUMEN

EXTRACTION FROM TAR SANDS. Extraction of Bitumen from the Tar Sands of Northern Alberta, K. A. Clark. Contract Rec., vol. 35, no. 51, Dec. 21, 1921, pp. 1107-1108. Important relation of problem to road building. Study of separation process undertaken by Industrial Research Dept. of University of Alberta.

BLIND

EMPLOYMENT. Employment of War-Blinded in German Industries, Hubert Hermanns Am. Mach., vol. 55, no. 26, Dec. 29, 1921, pp. 1921, pp. 1023-1025, 6 figs. Methods used to enable blind ex-soldiers to live independent of charity. Machine operation in manufacturing plants.

BOILER FEEDWATER

DISTILLED. Distilled Water for Boiler Feed at River Rouge Plant. Power, vol. 54, no. 26, Dec. 27, 1921, pp. 998-1003, 10 figs. Elaborate two-effect high-heat-level evaporator system furnishes distilled makeup to an amount up to 25 per cent of boiler feed.

SOFTENING. Softening and De-oxygenation of Boiler Feed Water. Chem. Age (Lond.), vol. 5, 130, Dec. 10, 1921, pp. 726-728. Discusses comparative merits of water-softening systems, importance of effecting oxygen removal, and chemical and physical methods for performing de-oxygenation.

BOILER OPERATION

EFFICIENT. Better Boiler Room Operation, C. W. DeForest Combustion, vol. 5, no. 6, Dec. 1921, pp. 246-248 and 260. Discusses investment cost; cost of fuel; and organization, personnel, supplies and maintenance costs. Paper read before Stoker Manufacturers Assn.

BOILER PLANTS

MANAGEMENT. Boiler House Management, David Brownlie. Proc. South Wales Inst. Engrs., vol. 37, no. 5, Nov. 10, 1921, pp. 405-438. Types of boilers and their relative advantages and disadvantages; mechanical stoking; economizers and feedwater heaters; superheaters; forced and induced draft; auxiliary machinery.

BOILER ROOMS

AIR SUPPLY. The Air Supply to Boiler Rooms, Richard W. Allen. Eng. & Indus. Management, (Cassier's Marine No.), Dec. 1921, pp. 35-42, 9 figs. One of most important points is that there should be equal distribution of preheated air to furnaces, so that no currents are set up and each furnace receives equal supply of air. Author deals with this problem. Results of trials taken under same conditions on one class of ship over period of four years show gains effected in each year as experience is accumulated.

BOILERS

DESIGN. Boiler Design and Other Fuel Efficiency Factors, F. G. Lister. Ry. Rev., vol. 70, no. 1, Jan. 7, 1922, pp. 5-8, 4 figs. Discusses fuel efficiency of locomotives by attention to mechanical details. Longer combustion chambers; flexible staybolts; tight front ends; floating bushings; automatic stokers; etc

BORING MACHINES

STANDARDIZATION. Standardization and Assimilation — II, H. Varley. Eng. & Indus. Management, vol. 6, no. 23, Dec. 8, 1921, pp. (650-652, 1 fig. A scheme of standardized boring practice.

BRIDGES, HIGHWAY

Batiscan River, Quebec. Batiscan Bridge [illegible] Montreal and Quebec. F. B. Panhaud. [illegible] 11, 1922, pp. 25-27, 6 figs. Seven-span steel structure, 1211 ft. long; bascule span is of Strauss patent type, motive power being [illegible] gasoline engine.

BRIDGES, LIFT

Bascule, Chicago. Wells Street Bridge Construction, R. F. Ituler[illegible]. Eng. World, vol. 20, no. 1, Jan. 1922, pp. 1-8, 12 figs. Describes Chicago's new double-leaf, double-deck, trunnion bascule bridge in course of construction.

BRIDGES, RAILWAY

Steel, Specifications for. Tentative Specifications for Steel Railway Bridges. Proc. Am. Soc. Civ. Engrs., vol. 47, no. 10, Dec. 1921, pp. 683-731, 15 figs. Progress report of special committee on specifications for bridge design and construction, followed by discussion.

BUILDING CONSTRUCTION

Mail Terminal, Chicago. Structural Design of U.S. Mail Terminal at Chicago. Eng. News-Rec., vol. 87, no. 25, Dec. 22, 1921, pp. 1010-1013, 8 figs. Steel 150-ft. truss in wall; girders for offset columns; provisions for future changes; ring frames at mail chutes; foundation cantilevers.

Steel Framing. Erection of Steel Building and 150-ft. Truss, W. J. Howard. Eng. News-Rec., vol. 87, no. 26, Dec. 29, 1921, pp. 1058-1060, 3 fig. Special methods for huge truss. Derrick on first floor with long boom places framing for six stories and roof.

BUILDINGS

Moving. The Moving of Brick Buildings. Engineering, vol. 112, no. 2921, Dec. 23, 1921, pp. 842-844, 10 figs. Describes two jobs recently completed by John Eichleay, Jr., Co., Pittsburg, Pa., namely, moving of a brick church in Pittsburgh 20 ft. back from its original position, and a steel frame building of eight stories a distance of 40 ft.

C

CABLES, ELECTRIC

Dry Core Paper. The Manufacture of Dry Core Paper Cable, Ikutaro Fukui. Inst. Elec. Engrs. of Japan, Jl (Denki Gakkwai Zasshi), no. 401, Dec. 1921, pp. 929-948. Describes various kinds of dry core paper cables and manufacturing processes connected therewith, and gives table of general dimensions and shapes of materials used in their manufacture. (in Japanese).

Faults, Localization of. Locating Faults in Armored Cable (Localisation des défauts sur les cables armés), L. Le Paige. Revue Universelle des Mines, vol. II, no. 4, Nov. 15, 1921, pp. 416-422, 3 figs. Discusses procedure in various failures of single and multiple conductor cables.

CAR LIGHTING

Methods. Railway Car Lighting (L'éclairage des voitures de chemins de fer), M. Bougrier. L'Electricien, vol. 52, nos. 1287 and 1288, Nov. 1, and 15, 1921, pp. 481-488 and 505-513, 11 figs. Nov. 1. Describes the various methods in use in different countries including lighting by candle, oil, gas, acetylene, and electricity, and gives cost data. Nov. 15: Describes the Brown-Boveri individual electric equipment, its operation and upkeep.

CAR WHEELS

Foundry. A Unique Foundry for Production of Car Wheels. Can. Foundryman, vol. 12, no. 11, Nov. 1921, pp. 17-20, 6 figs. Molds are placed on semi-automatic moving platform and taken to place of pouring; shaking out and annealing with very little effort.

Tires, Sorbitic Steel. Sorbitic Steel for Tires. Engineer, vol. 132, no. 3442, Dec. 16, 1921, p. 636, 4 figs. on p. 657. Includes tables showing results of tests made with three railway and three tramway tires, one of each set being treated by the Sandberg Sorbitic steel process. Results show that process is successful in obtaining improved ultimate tensile strength and hardness of tires.

CARS

Connectors. The Development of the Robinson Connector. Ry. Age, vol. 71, no. 26, Dec. 24, 1921, pp. 1253-1253, 9 figs. Detailed description of new design incorporating a number of improvements.

CARS, COAL

Electric Tippers. Electrically Equipped Railway Truck Tippers, E. H. Rousham. Electrician, vol. 87, no. 2276, Dec. 30, 1921, pp. 822-825, 10 figs. Describes the Babcock & Wilcox tipping ram, and the tipper manufactured by Ed. Bennis & Co. Ltd.; also overhead which type, hydraulic tipping rams, electric rotary tipplers, clamping methods, automatic clamping gear, etc.

CARS, FREIGHT

Wood Construction. The Use of Wood in Freight Car Construction, H. S. Saskett. Ry. Mech. Engr., vol. 96, no. 1, Jan. 1922, pp. 27-32, 6 figs. Advantages of composite design as against all-steel construction; relative advantages of double and single sheathed box car; composite gondola car; refrigerator car.

CARS, PASSENGER

Electric Railway. New Stock For Tynemouth Electrified Branches, North Eastern Railway. Ry. Gaz., vol. 35, no. 24, Dec. 9, 1921, pp. 877-884, 12 figs. Passenger vehicles of improved design built for this important electrified passenger service.

Sleeping. New Sleeping Cars for the Canadian Pacific. Ry. Age, vol. 71, no. 27, Dec. 31, 1921, pp. 1301-1394, 7 figs. Composite cars of 12 section and compartment types have special facilities for comfort of passengers.

CASE-HARDENING

Iron and Steel. Case Carburizing of Iron and Steel (Härtung von Eisen und stahl), Willy Hacker. Metall-Technik, vol. 47, no. 14, Sept. 15, 1921, pp. 85-87. Review of development and processes during last few years.

CASTING

Metal Molds. Casting in Metal Moulds, S. A. E. Wells. Metal Industry (Lond.), vol. 19, no. 25, Dec. 16, 1921, pp. 501-502. Discusses the three classes, viz., (1) that in which metal flows into mold under force of its own weight, (2) die castings, and (3) part chills in ordinary sand molds. From paper read before joint meeting of Inst. of Metals and Instn. British Foundrymen

Permanent Molds. Permanent Moulds, Edward D. Gleason. Metal Industry (Lond.), vol. 19, no. 20, Nov. 11, 1921, pp. 377-379. Description of methods of making plaster molds for finished castings to eliminate machining operations.

CELLULOID

Manufacture. Manufacture of Pyroxylin Plastics, J. R. DuPont. Chem. & Met. Eng., vol. 26, no. 2, Jan. 11, 1922, pp. 65-70, 6 figs. Properties of celluloid; methods of mixing cellulose nitrate with camphor and alcohol; stabilizing; filtering; rolling; baking; sheeting; polishing; etc.

CHROME STEEL

Ball-Bearing. The Manufacture of Chromium Ball-Bearing Steel in the Heroult Furnace, F. T. Sisco. Chem. & Met. Eng., vol. 26, no. 2, Jan. 11, pp. 71-76, 2 figs. Description of melting and processing of electric ball-bearing steel, with a view of the most serious defects in this class of material. Recommended practice for elimination and control of these defects.

Chrome-Molybdenum. Chrome-Molybdenum-Steel Applications from the Consumer's Viewpoint, C. N. Dawe. Soc. Automotive Engrs. Jl., vol. 10, no. 1, Jan. 1922, pp. 47-50 and 62, 2 figs. Gives results of physical tests, comparing medium-carbon, chrome-molybdenum, chrome-vanadium, chrome-nickel and chrome steels. Discusses case-hardening grades of Steel.

CITY PLANNING

Topographical Maps. The Advantages of a Topographical Map in City Planning, Jefferson C. Grinnalds. Good Roads, vol. 61, no. 22, Nov. 30, 1921, pp. 243-245, 250 and 252. Discusses kind of map necessary, steps in planning, new territory to be laid out and old city replanned, etc. Describes maps of Baltimore began by Topographical Survey Commission in 1894, which is said to be ideal. See also Mun. & County Eng., vol. 61, no. 6, Dec. 1921, pp. 221-225. Paper read before Am. Soc. Mun. Improvements.

COAL

Low-Temperature Carbonization. Carbonization at Low Temperature, J. D. Davis. Gas. Age-Rec., vol. 48, no. 19, Nov. 26, 1921, pp. 707-711, 1 fig. Discusses what is meant by low-temperature carbonization, its products and their uses, suitable coals, retorts, etc. See also Colliery Guardian, vol. 122, no. 3179, Dec. 2, 1921, pp. 1533-1534 and Can. Min. Jl., vol. 42, no. 47, Nov. 25, 1921, pp. 926-929.

Low-Temperature Carbonization in England, David Brownlie. Chem & Met. Eng., vol. 26, no. 1, Jan. 4, 1922, pp. 23-27, 9 figs. Survey of British practice and detailed description of construction and operation of experimental Plant of Low-Temperature Carbonization, Ltd., at Barugh, near Barnsley.

COAL HANDLING

Equipment. Springdale Mine Furnishes Fuel to West Penn Power Co. Plant, Cleaning Every Car of Coal Before Weighing, D. J. Baker. Coal Age, vol. 20, no. 25, Dec. 22, 1921, pp. 993-999, 6 figs. Power plant situated next to headframe. For weighing, coal is screened to lump, nut and slack before picking; nut and slack are united and reassembled; lump is then crushed and with nut and slack goes to boilers.

COAL STORAGE

Concrete Bins and Pits. Economy of Concrete Bins and Pits for Coal Storage, A. C. Irwin. Elec. Rev. (Chicago), vol. 79, no. 22, Nov. 26, 1921, pp. 811-816, 16 figs. Storage requirements and methods, including submerged pits; effect of storage on properties of coal; spontaneous combustion.

COKE OVENS

Beehive. Beehive Coke Ovens with Central Generator in Smaller Gas Works ([illegible] Kleinersen Gaswerken. H. Kleinholz Gas- u. Wasserfach, vol. 64, no. 38, Sept. 17, 1921, pp. 619-623, 8 figs. Describes vertical beehive ovens constructed by C. Otto & Co. for gas works of German town. Notes on phenomena occurring with coking; water-gas production in chamber furnace; heating, operation, etc.

By-Products. By-Product Coke Ovens in the Gas Industry, B. W. Winship. Am. Gas Jl., vol. 115, no. 25, Dec. 17, 1921, pp. 535-541, 7 figs. Discusses operation of coke ovens from the standpoint of meeting the seasonal demands of the [illegible].

Silica Brick. Silica Brick Coke-Ovens, A. H. Middleton. Gas Jl., vol. 156, no. 3055, Nov. 30, 1921, pp. 630-631. The advantages of using silica brick in place of quartzite for construction of coke-oven walls are (1) greater output and greater thermal efficiency, (2) greater durability, (3) resistance to corrosion where salty coal is used, and (4) possibility of varying heat treatment. Paper read before Coke-Oven Managers' Assn.

COMPRESSED AIR

Handling Material by. Handling Material by Compressed Air, F. A. McLean Can. Machy., vol. 26, no. 25, Dec. 22, 1921, pp. 19-23, 10 figs. Time is saved and economy effected. Notes on single acting air hoist, capacities of straight lift hoists, and operating costs.

Intercooling. Value of Intercooling Compressed Air, C. K. Bennett. Nat. Engr., vol. 25, no. 12, Dec. 1921, pp. 613-616, 6 figs. Advantages of intercooling. How saving in power is effected and safety maintained.

CONCRETE

Hydrated Lime in Paving. Advantages of Hydrated Lime in Paving Concrete, Tyrrell B. Schertzer. Can. Engr., vol. 42, no. 1, Jan. 3, 1922, pp. 111-112. It is said to have water-tightening properties, to increase density of concrete, and make placing easier.

CONCRETE CONSTRUCTION, REINFORCED

Railways. Reinforced-Concrete Constructions on Railways, W. W. Grierson. Engineer, vol. 132, no. 3441, Dec. 9, 1921, pp. 628-629, 10 figs. Deals with use of reinforced concrete in smaller constructions, particularly those employed by the signal and telegraph engineer, including telegraph and signal posts, gate posts, etc.

CONCRETING

Freezing Weather. Concreting in Freezing Weather. Contract Rec., vol. 36, no. 2, Jan. 11, 1922, pp. 30-32, 3 figs. Some precautions that practical experience has determined as necessary for successful construction during winter season.

CONTRACTS

Uniform Construction. Uniform Construction Contracts. Contract Rec., vol. 36, no. 1, Jan. 4, 1922, pp. 10-12. Recent conference formulates plans to standardize documents relating to contracting. Investigation discloses over 200 forms in common use.

CONVEYORS

Machinery for Elevators and. Conveying and Elevating Machinery, Gardiner Mitchell. Engineering, vol. 112, no. 2921, Dec. 23, 1921, pp. 866-870, 17 figs. Deals with the various types of conveyors and elevators, and includes tables giving standard details and particulars and standard elevator chains.

Steel Bands. The Use of Steel Bands for Power Transmitting and Conveying Purposes, Bernard Kruger. Jl. Western Soc. of Engrs., vol. 26, no. 12, Dec. 1921, pp. 428-432. Discusses increased use of steel bands, avoiding breaks in band, composition and tensile strength of bands, and compares leather, rope, chain and steel band systems.

COPPER

Working [illegible]. Experiments in the Working and Annealing of Copper. [illegible] vol. 112, no. 2922, Dec. 30, 1921, pp. 899-901, 7 figs. Results of rolling and hardness tests and specific gravity tests. Notes [illegible] of impurities on effective annealing temperature of cold-drawn copper. (Abstract.) Paper read before Inst. [illegible]

CORROSION

[illegible], D. M. Strickland. Sci. Am., vol [illegible] Some of controlling factors, and how account is best taken of them.

[illegible]ING

[illegible], F. A. Lacey. Management Eng., vol. 2, no. 1, Jan. 1922, pp. 25-28, 4 figs. How it can be measured through idleness. Shows examples of Gantt idleness charts.

Foundry. Foundry Costs and Establishment Charges, Daniel Adamson. Engineering, vol. 112, no. 2922, Dec. 30, 1921, pp. 894-895. Author endeavours to arrive at a reliable method of estimating cost of many varieties of castings in green sand, dry sand or loam, that are produced in foundry attached to a general engineering business. Notes introducing discussion before Manchester Assn. Engrs.

CRANES

Hooks for, Strength of. The Strength of a Hook or "Clivvy", Charles D. Mottram. Quarry & Surveyors' & Contractors' Jl., vol. 26, no. 297, Nov. 1921, pp. 447-449, 4 figs. Discusses safety load and factor of safety; gives curves and formulas.

Overhead Drives. Overhead Crane Drives, A. W. Knight. Machinery (Lond.), vol. 19, no. 482, Dec. 22, 1921, pp. 352-354, 4 figs. Describes some typical cranes and works out amount of movement of one side of crane in advance to the other, when the crab and its suspended load is at opposite end to drive on cross shaft.

Shifting Gear on Gantry. Use Shifting Gear on German Cranes. Iron Trade Rev., vol. 70, no. 2, Jan. 12, 1922, pp. 140-142, 5 figs. Describes gantry cranes equipped with swivel trucks and lifting jacks by means of which whole crane may be quickly and readily transferred from one runway to another. Built by Fried. Krupp Corp., Magdeburg-Buckau.

CRANKSHAFTS

Manufacture. The Manufacture of Crankshafts Engineering, vol. 112, nos. 2919 and 2920, Dec. 9 and 16, 1921, pp. 777-778, 9 figs., partly on supp. plate, and pp. 811-813, 14 figs. Describes works and manufacturing methods of Clarke's Crank & Forge Co., Ltd., Lincoln, England.

D

DIES

Continuous Rolling. Continuous Die Rolling, G. R. Norton. Soc. Automotive Engrs. Jl., vol. 10, no. 1, Jan. 1922, pp. 43-46, 11 figs. Describes process of continuous die rolling; improvements made; physical characteristics of steels; cost of operation; equipment used; etc. See also Iron Age, vol. 109, no. 3, Jan. 19, 1922, pp. 207-209, 11 figs.

DIESEL ENGINES

Air Compressors. *See Air Compressors, Marine Diesel Engines.*

DRAINAGE

Pumping Plants. Drainage Pumping Plants, L. C. Craig. Mun. and County Eng., vol. 61, no. 6, Dec. 1921, pp. 215-219. Points out necessity for pumping for large percentage of swamp and overflowed lands in United States; discusses size of pumping plant, type of engine and pump to use, electric pumping, and use of Diesel engines for drainage pumping plants. Paper read before Nat. Drainage Congress.

DRILLING MACHINES

Heavy-Duty. Economy of Heavy-duty Drilling, Fred R. Daniels. Machy. (N.Y.) vol. 28, no. 5, Jan. 1922, pp. 349-355, 16 figs. Examples of work for which heavy duty drilling machine is adapted.

DROP FORGINGS

Heat Treatment. Heat-treatment of Drop-forgings. Machy. (N.Y.), vol. 28, no. 5, Jan. 1922, pp. 384-388, 6 figs. Furnaces design and fuels suitable for treating drop forgings.

DUST

Collectors. Mechanical Methods of Allaying Dust, P. H. Warren. Australasian Inst. Min. & Metallurgy Proc., no. 42, June 30, 1921, pp. 31-47 and (discussion) 47-100, 10 figs. Describes tests carried out at Borken Hill South mine with the Clifton dust, collector.

E

EDUCATION, ENGINEERING

Industrial Needs. Engineering Education. Mech. Eng., vol. 44, no. 1, Jan. 1922, pp. 1-7 and 42. Group of papers in which are presented particular needs of industries and problems that confront engineering faculties: Professional Engineering Education for the Industries, Francis C. Pratt. A National Policy on Engineering Education, A. G. Christie. Engineering Education as Viewed by the Industrialist, J. E. Otterson.

ELECTRIC CIRCUITS, D.C.

Voltage Drop. How to find Voltage-Drop in Electric Circuits, Edgar P. Slack. Power, vol. 54, no. 26, Dec. 27, 1921, pp. 1009-1011, 1 fig. Chart from which line drop, length of circuit, currents values and size of conductors can be determined without calculation

ELECTRIC FURNACES

[illegible] Iron Age, vol. 109, no. 1, Jan. 5, 1922, pp. 17-19 How to avoid delays in each of the eight major operations of making steel in furnaces having movable electrodes.

Basic. Basic Electric Furnace for Cast Iron. Can. Foundryman, vol. 12, no. 11, Nov. 1921, pp. 32-34. Important characteristics of refining in the basic-hearth electric furnace are: (1)it is strongly reducing, (2) it is degasifying to an appreciable extent, (3) it is cleansing of entrained slags and oxides, and [illegible]

Forging. Builds Electric Forging Furnace, G. M. Little. Iron Trade Rev., vol. 69, no. 26, Dec. 29, 1921, pp. 1689-1692, 3 figs. Discusses difficulties encountered in construction of carbon resister-type furnace for heat treating and forging work. Gas or oil used to prevent resister oxidation. Insulation problem solved.

Gray-Iron. Practical Aspects of Electric Gray Iron, C. H. Vom Baur. Iron Age, vol. 109, no. 1, Jan. 5, 1922, pp. 51-52. Advantages over the cupola. Actual results from heats made recently. Effect of nickel and chromium. Compara- [illegible]

Induction. Melting Steel in an Induction Furnace, H. A. Winne. Iron Trade Rev., vol. 70, no. 2, Jan. 12, 1922, pp. 138-139, 2 figs. Describes induction furnace of 4000-lb. hearth capacity in successful operation at Pittsfield works of Gen. Elec. Co. for more than a year. It is a single-phase, single-ring (horizontal) type; lining consists of two essential parts, an outer layer of insulating and refractory brick, and inner rammed lining, or hearth proper.

Railway Shops. The Electric Furnace on Railroad Work, Larry J. Barton. Western Machy. World, vol. 12, no. 11, Nov. 1921, pp. 444-446, 4 figs. Describes installation of Southern Pacific Co., at their Sacramento shops; 6-ton Heroult furnace.

Reactance Requirements. Furnace Reactance Requirements Need Consideration, P. B. Short. Elec. World, vol. 79, no. 2, Jan. 14, 1922, pp. 81-82, 4 figs. Discusses growing tendency to use higher operating voltages and the importance which public utilities are attaching to power factor.

ELECTRIC LOCOMOTIVES

Paulista Railway, D.C. 3000 Volt Direct-Current Locomotives for the Paulista Railways, John A. Clarke, Jr., Elec. Jl., vol. 19, no. 1, Jan. 1922, pp. 17-23, 11 figs. Discusses electrification of Jundiahy-Campinas section of the Sao Paulo state railway, and gives data on passenger and freight locomotives. and auxiliaries..

Storage-Battery. Data on Operation of Storage Battery Locomotive, Jerome C. White. Coal Industry, vol. 4, no. 12, Dec. 1921, pp. 581-583, 2 figs. Costs and operating data obtained from a storage-battery locomotive used as a main haulage machine. Paper read before Coal Min. Inst. of Am.

Explosion Proof Electric Mine Locomotives, L. C. Illsley. Coal Industry, vol. 4, no. 12, Dec. 1921, pp. 588-591, 9 figs. Description of work being carr ed on by Bur. of Mines in connection with investigations of storage-battery locomotives; requirements for approved equipment; rules for inspection.

ELECTRIC MOTORS, A.C.

Nomogram for Induction. Induction Motor Nomogram, R. G. Warner. Jl. Am. Inst. Elec. Engrs., vol. 40, no. 10, Oct. 1921, pp. 808-814, 7 figs. Movable diagram for reading all performance characteristics of any three-phase induction motor.

Single-Phase Induction. Current Locus of Single-Phase Induction Motors, J. K. Kostko. Am. Inst. Elec. Engrs., Jl., vol. 41, no. 1, Jan. 1922, pp. 30-36, 7 figs. Deals with problem od determination of performance and constants of an existing motor on basis of a few simple tests. Problem is dealt with by method which is believed to combine accuracy with comparative simplicity of final results.

Synchronous Induction. Induction-Type Synchronous Motors, Laurence H. A. Carr. Engineer, vol. 132, no. 3444, Dec. 30, 1921, pp. 713-714, 3 figs. Discusses theory and compares them with other types of machines. Notes on construction, starting and synchronizing, peculiarities of single-phase rotors, reliability, excitation voltage, control and switchgear, efficiency, price, etc. (Abstract.) Paper read before Instn. Elec. Engrs. (British.)

ELECTRIC PLANTS

Automatic. Automatic Plant Permits Development of Small Power Site, C. M. Gilt. Elec. World, vol. 78, no. 25, Dec. 17, 1921, pp. 1213-1214, 3 figs. Generator started simply by energizing line connecting automatic plant to main station..

Commonwealth Edison Co., Chicago. Calumet Station of the Commonwealth Edison Co., A. D. Bailey. J. Western Soc. of Engrs., vol. 26, no. 12, Dec. 1921, pp. 420-427, 9 figs. Discusses station now under construction, with ultimate capacity of 180,000 kw.; present installation consists of one 30,000-kw. Westinghouse Tandem compound unit and one 30,000-kw. General Electric unit. Boiler station to consist of seven 1,500-hp. Babcock & Wilcox boilers fired with forced-draft chain-grate stokers and augmented with superheaters and steel-tube economizers.

Hartford Electric Light Co. Station Electrical Layout for Supplying Local and Regional Service Elec. World, vol. 78, no. 26, Dec. 24, 1921, pp. 1269-1273, 9 figs. Flexibility and simplicity of design effectively combined in South Meadow station of Hartford Elec. Light Co. Symmetrical development by sections to meet dual service.

Possible Economies. Possible Economies in Large Electric Generating Stations, Emile Rauber. Engineer, vol. 132, no. 3444, Dec. 30, 1921, pp. 669-670. States that considerable progress may still be made in economizing fuel by (1) using higher steam pressures; (2) employing higher degree of superheat; (3) heating feedwater by "bleeding" turbines; and (4) preventing all losses of heat. (Abstract). Report of Commission appointed by French Minister of Pub. Works, printed in Journal Officiel.

ELECTRIC TRANSMISSION LINES

Overhead Grounded Wire. Questions on the Economic Value of the Overhead Grounded Wire, E. E. F. Creighton. Am. Inst. Elec. Engrs. Jl. Vol. 41, no. 1, Jan. 1922, pp. 21-29, 1 fig. Definite conclusion is drawn that expense of overhead wires on wooden pole lines is, in general, an economic waste. In particular cases it may be justified. On metal tower construction, use of overhead grounded wire is, in general, fully justifiable. Gives analyses made for presentation to a public service commission. Bibliography.

Protection. Protection of Transmission Lines With Condensers, George Lewis. Elec. Rev. (Chicago), vol. 79, nos. 19 and 29, Nov. 5 and 19, 1921, pp. 691-694 and 765-769, 14 figs. High-frequency disturbances and high-voltage surges relieved as result of satisfactory performance of static condensers; influences of short-circuit eliminated in test on heavy line.

ELECTRIC WELDING, ARC

Boiler Repairs. Electric Arc Welding for Boiler Repairs. Ry. Elec. Engr., vol. 12, no. 11, Nov. 1921, pp. 415-420, 19 figs. Special committee of Master Boiler Makers' Assn. reports best methods of reconditioning boilers.

Cyc-Arc Process. The "Cyc-Arc" Process of Automatic Electric Welding, L. J. Steele and H. Martin. Electrician, vol. 87, no. 2273, Dec. 9, 1921, pp. 734-735. Discusses development; and the three essential variables, viz., (A) amount of current through the arc, (b) length of arc upon striking, and (c) length of time it had to be maintained before making the weld. Results of welding experiments and tests with the cyc-arc apparatus.

ELECTRIC WELDING, RESISTANCE

Methods and Apparatus. Electric Resistance Welding (La soudure électrique par résistance), R. Verdier, La Nature, no. 2480, Oct. 15, 1921, pp. 246-251, 7 figs. Describes the three methods and apparatus used.

ELECTRICITY SUPPLY

Rates Rates for Electrical Energy and Service, F. W. C. Bailey. Jl. Am. Inst. Elec. Engrs., vol. 40 no. 10 Oct. 1921, pp. 803- 808, 6 figs. Notes on straight line step, and block meter rate as flat Wright. and Hopkinson demand rates. Points out that a general or large power rate schedule should be based upon and conform to load-factor cost curve.

ENAMELING

Cast Iron and Steel. Enameling Cast Iron and Steel Materials, F. L. Prentiss Iron Age, vol. 109, no. 1, Jan. 5, 1922, pp. 13-16, 9 figs. Methods and apparatus used. Care needed in preparing surfaces for treatment. Burning on the enamel.

ENGINEERS

License Law, N. Y. State. The New York State License Law, S. G. George. Cornell Civil Engr., vol. 30, no. 4, Jan. 1922, pp. 53-54. Professional engineers and land surveyors required to obtain licenses to practice in New York State from May 5, 1923.

ENGINEHOUSES

Interior Turntable. Rectangular Enginehouse with Interior Turntable. Eng. News-Rec., vol. 87, no. 26, Dec. 29, 1921, pp. 1064-1066, 4 figs. Two Canadian railways adopt novel plan to reduce winter trouble at terminal by putting turntable under cover.

F

FACTORIES

Layout. Factory Lay-out as an Aid in Reducing Costs. Machinery (Lond.), vol 19, no. 480, Dec. 8, 1921, pp 293-296, 8 figs. Describes new plant of Colburn Machine Tool Co. Cleveland Ohio, which has been laid out with a view to economy in manufacturing.

Laying Out a Factory for Production Work, Frank W. Curtis, Am. Mach., vol. 56, nos. 2 and 3, Jan. 12 and 19, 1922, pp. 56-58 and 97-99, 8 figs. How kind and amount of equipment are estimated. Arranging machines. Uses of operation sheets, equipment records, and conveyors.

TELEPHONE. Methods in a Telephone Factory. Eng Production, vol. 3 no 64, Dec. 22, 1912, pp. 583-587, 14 figs. Describes works and practice of British L. M. Ericsson Mfg. Co., Ltd., at Beeston for manufacture od telephones, telephone exchange and private branch switchboards and allied apparatus cabinet work, etc.

FACTORY MANAGEMENT

See Industrial Management.

FILING SYSTEMS

Z CHARTS. Filing the Z Chart, Arthur R. Burnet. Management Eng., vol. 2, no. 1, Jan. 1922, pp. 47-50, 2 figs. Describes system of filing which it is claimed, follows principles best suited to classification and indexing of accounting records.

FLIGHT

McCOOK FIELD ALTITUDE. Functioning of Supercharger in Altitude Flight. Aviation, vol. 12, no. 2, Jan. 9, 1922, p. 51. Excerpt of report of John A MacReady on his record breaking altitude flight at McCook Field, dealing with technical aspects of flight and giving summary of data obtained with respect to supercharger, engine and propeller.

SOARING. The Starting of Soaring Airplanes (Start von Segelflugzeugen), E. Offermann. Zeit, für Flugtechnik u. Motorlufstchiffahrt, vol. 12, no. 22, Nov. 30, 1921, pp. 327-331, 13 figs. Investigation of following problems is said to be necessary in order to diminish danger to life and material: Improvement in airplane construction that will render it possible to start and fly with as low a wind as possible; training of pilot especially for motorless or soaring flight; study of relations between formation of land and nature of soil and air movements and their dependence upon one another.

FLOOD CONTROL

MIAMI CONSERVANCY DISTRICT. Flood Measures in the Vicinity of Dayton, Ohio, Arthur E. Morgan. West. Soc. Engrs. Jl., vol. 27, no. 1, Jan. 1922, pp. 1-6, and (discussion) pp. 6-12, 9 figs. Account of difficulties encountered in planning flood control work in Miami Conservancy District. In discussion construction details are dealt with.

FLOW OF WATER

SPIRAL RIVETED PIPE. Flow of Water Through Spiral Riveted Steel Pipe, F. W. Crewe and R. R. Martin. Eng. & Contracting, vol. 57, no. 2, Jan. 11, 1922, pp. 41-42, 2 figs. Data and results of investigation upon flow of water through 4, 6, 8 and 10 in. galvanized spiral riveted steel pipes, dealing primarily with relation of friction loss to velocity in straight runs, both when flow was directed with and against lap. (Abstract.) Bul. Eng. Experiment Station of Purdue University.

FORGING

MILD STEEL. Forging Experiments with Mild Steel. Paul J. Junkers. Forging & Heat Treating, vol. 7, nos. 10 and 11, Oct. and Nov. 1921, pp. 518-523 and 553-556, 22 figs. Oct: Results of experiments to determine resistance of steel to deformations and influence of kneading and forging temperatures upon physical properties of a 13 and .50 C steel. Nov.: Improvement in structure due to forging is greater in .50 than in .13 carbon steel; finishing temperatures important.

FOUNDRIES

BRASS. Casting Small Parts in Production Foundry, Gerard Frazar. Iron Age, vol. 108, no. 26, Dec. 29, 1921, pp. 1653-1656, 7 figs. Describes new foundry of Gilbert & Barker Mfg. Co., Springfield , Mass., equipped for continuous pouring which when run at capacity will give employment to about 300.

CHILLED ROLLS. New Foundry for Casting Chilled Rolls, George F. Tegan. Iron Age, vol. 109, no. 1, Jan. 5, 1922, pp. 38-42, 7 figs. Raw material charged in air furnaces direct from stock pile at Garrison foundry, Pittsburgh.

CORE MIXING. Core and Sand in the Foundry, G. Pouplin. Brass world, vol. 17, no. 12, Dec. 1921, pp. 345-350. The making and mixing of cores as practised today in the best French foundries. Notes on core drying, glutrin and avebenc, and action of tar-oil on sand. (Abstract.) From Fonderie Moderne.

ENGINEERING COSTS. Obtaining Engineering Costs in Foundry and Machine Shop, Howell B. May. Iron Trade Rev., vol. 69, nos. 19, 21, 23 and 25, Nov. 10, 24, Dec. 8 and 22, 1921, pp. 1218-1221, 1356-1358, 1456-1458, 1485-1489 and 1619-1622 and 1630, and vol. 70, no. 3, Jan. 19, 1922, pp. 206-210, 30 figs. [illegible] of adequate costs with detailed application [illegible] iron and brass foundries machine shop and [illegible] metal department. Nov. 10: General outline of plan. Nov. 24: Cost plan [illegible] and expense account. Dec. 22 Consolidation [illegible] Jan. 19 Financial Statements, graphics and [illegible]

RAILWAY IRON AND STEEL. Control in a Railway Iron and Steel Foundry, G. N. Shawcross. Engineering, vol. 112, no. 2920, Dec. 16, 1921, pp. 832-836, 6 figs. [illegible] materials in well-known [illegible] & Yorkshire Ry. at Horwich, England, showing [illegible] what methods work is turned out. Address [illegible]

FUELS

AMERICA'S RESOURCES. America's Fuel Resources. Robert G. Skerrett. Sci. Am., vol. 126, no. 2, Feb. 1922, pp. 86-87, 3 figs. Data on deposits and consumption. Presents charts showing how consumption of petroleum and coal has increased since 1880.

FURNACES

OXY-ACETYLENE. An Oxygen-Acetylene High-Temperature Furnace, Hewitt Wilson. Am. Ceramic Soc. Jl., vol. 4, no. 10, Oct. 1921, pp. 835-841, 2 figs. Detailed description to show use of oxy-acetylene gas in a small furnace for using refractory cones. Advantages of furnace.

FURNACES, BOILER

SOLID AND LIQUID FUELS. The Pace Patent Furnace Door. Iron & Coal Trades Rev., vol. 103, no. 2808, Dec. 23, 1921, p. 917, 1 fig. Describes furnace for burning alternatively solid or liquid fuels and gives comparison of cost.

FURNACES, HEATING

INGOT-REHEATING. Ingot Reheating Furnace, H. E. Smythe. Iron Age, vol. 109, no. 2, Jan. 12, 1922 pp. 149-150, 1 fig. New design to avoid imperfect and unequal heating by proper control of incoming gases.

FURNACES, INDUSTRIAL

HIGH-PRESSURE GAS SYSTEM. High Pressure Gas and Its Application to Industrial Furnaces, F. J. Evans. Am. Soc. for Steel Treating Trans., vol. 2, no. 3, Dec 1921, pp. 213-222, 7 figs. Discusses low-pressure air and gas system with two-valve control and manual proportioning, and with single-valve control and automatic proportioning, and high-pressure gas system with single valve control and automatic proportioning.

G

GAS ANALYSIS

APPARATUS FOR CONTINUOUS. Apparatus for the Continuous Analysis of Gas, R. Mezger and M. Mueller. Am. Gas Jl., vol. 115, no. 26, Dec. 24, 1921, pp. 555-556. Describes apparatus developed in laboratories of Stuttgart Gas Works and used there with great success. Advantages of apparatus are: Work involved in manipulation is extremely small; it is possible to carry out three analyses simultaneously; time of analysis is reduced considerably; danger of obtaining incorrect results is eliminated. Translated from Gas u. Wasserfach, p. 63, 1921.

GAS MANUFACTURE

RECUPERATION. Preheating Air for Gas Furnaces, O. Lellep. Gas Age-Rec., vol. 48, no. 21 Dec. 10, 1921, pp. 773-776, 2 figs. Discusses the question of whether recuperation does or does not pay for industrial gas furnaces, and gives results of experiments. See also Am. Gas Jl., vol. 115, no. 22, Nov. 26, 1921, pp 479-482, 3 figs.

RETORTS. Observations on the Practice of Vertical Retorts. Gas Jl., vol. 156, no. 3053, Nov. 16, 1921, pp. 501-503 and (discussion) 503-504. Describes Walsall Woodall-Duckham installation; drying, lighting up, and letting down; emphasizes importance of each portion of plant working to the clock.

GAS PRODUCERS

CORROSION OF COOLING SYSTEM. Corrosion of a Producer-Gas Cooling System, Lloyd E Jackson. Chem & Met Eng, vol. 26, no. 2, Jan. 11, 1922, pp. 60-64, 5 figs. Cooling water of high acidity and containing much dissolved oxygen and suspended coke dust causes deterioration of cooling system at plant of Providence Gas Co., Providence, R. I. Remedial measures are suggested.

TESTS WITH ALBERTA COALS. Gas Producer Trials with Alberta Coals, John Blizard and E. S. Malloch. Canadian Dept. of Mines, Bul. no. 33, 1921, 40 pp. 23 figs. Tests were carried out in Westinghouse, double-zone, gas producer. Aim of trials was to ascertain suitability of the various fuels for giving a clean combustible gas when burned in the producer. Results show that all fuels except one are suitable but that less than one-half can be recommended for continuous operation in producer.

GASES

PUMP AND MIXER. The Roturbo Gas Pump and Mixer. Engineer, vol. 132, no 3444, Dec. 30, 1921, p. 704, 1 fig. Describes Rees Roturbo gas pump and mixer for creating a very intimate mixture between gases and liquids and effecting required solution or chemical action in smallest possible time and space. It is designated to draw large volumes of gas from comparatively low vacuum and to mix them with the entraining liquid.

GEAR CUTTING

Broaching Machine. Gear Cutting by Broaching Machine. Eng. Production, vol. 3, no. 65, Dec. 29, 1921, p. [illegible] gears, circular cutters, saws, etc., particularly adapted for manufacture on extensive basis, [illegible]

Spur-Gear Machine. Cutting Spur Gears on the Shaper. Eng. Production, vol. 3, no. 64, Dec. 22, 1921, p. 87, 1 fig. [illegible] for generation of spur gears having correct teeth form, no matter what the number of teeth.

GEARS

Involute. Design of Bevel, Helical and Worm Involute Gears, A. B. Cox. Am. Mach., vol. 56, no. 3, Jan. 19, 1922, pp. 101-107, 8 figs. Application of data of author's previous articles. Determination of helix and tooth angles. Relation between interference, number of tooth and sliding action.

The Evolution of the Involute Gear Tooth—X, A. Fisher. Machinery (Lond.), vol. 19, no. 483, Dec. 29, 1921, pp. 380-384, 6 figs. Discusses relation between tooth depth and thickness; backlash; generating teeth of conjugate thickness.

Tooth Shape. Gear Tooth Shape and Its Relation to Standardization, E. W. Miller. Automotive Industries, vol. 45, no. 24, Dec. 15, 1921, pp. 1167-1173, 26 figs. Discusses properties of involute form of gear tooth. True involute teeth with a certain pressure angle and relation between addendum and diametral pitch will not interfere with pinions down to 12 teeth. Such a system would facilitate universal interchangeability. Condensed from paper read before Am. Gear Manufacturers' Assn.

Worm. Worm Gear Generator. Machy. (Lond.), vol. 19, no. 481, Dec. 15, 1921, pp. 325-327, 9 figs. Describes in detail machine built by Smith & Coventry, Ltd., Manchester.

GIRDERS

Bending Moments. Graphic Determination of Bending Moments in a Girder Supporting Traffic Loads by Means of Cross Bars (Détermination Graphique des moments fléchissants maxima dans une poutre supportant des charges mobiles par l'intermédiaire des traverses), Smoukovitch and Barbillion. Le Génie Civil, vol. 79, no. 25, Dec. 17, 1921, pp. 533-535, 5 figs.

GRAIN ELEVATORS

Explosions. The Northwestern Elevator Explosion, David J. Price. Jl. Western Soc. of Engrs., vol. 26, no. 12, Dec. 1921, pp 401-417 and (discussion) 417-419, 7 figs Discusses in detail damage done to elevator operated by Armour Grain Company, South Chicago; theories advanced as to cause of explosion; lessons to be learned from the explosion; recommendations.

Pneumatic. Pneumatic Grain Elevators, R. E. Knight. Engineering, vol. 112, no. 2921, Dec. 23, 1921, pp. 864-866, 1 fig. Deals with pneumatic discharge of grain from ships, and more particularly with two modern examples of floating and quayside plants in which oil engines or motors, and high-speed rotary exhausters, have replaced vertical or horizontal compound steam engines and reciprocating exhausters, as main power plant of installation. Paper read before Instn. Mech. Engrs. (British). See also Engineer, vol. 132, no. 3443, Dec. 23, 1921, pp. 685-687, 1 fig.

GRINDING

Differential Spider Arms. Grinding Differential Spider Arms, Charles Kotersall. Am. Mach., vol. 55, no. 25, Dec. 22, 1921, pp. 1009-1010, 3 figs. Method which eliminates use of centers and an inspection gage for insuring accuracy in alignment

Surface. Why Work Curls Towards the Wheel While Being Surface Ground, E. A. Dixie. Am. Mach., vol. 55, no. 25, Dec 22, 1921, pp. 1006-1007, 4 figs. Plausible theory deduced from long experience. Work heated beyond critical point in numberless places takes permanent set when quenched by coolant.

GRINDING MACHINES

Railroad Shops. The Grinding Machine in the Railroad Shop, Frank A. Stanley. Am. Mach., vol. 56, no. 2, Jan. 12, 1922, pp. 64-65, 10 figs. Advantages of grinding for finishing parts to size. Grinding operations on locomotive parts. Increasing efficiency of motion mechanism.

H

HANDLING MATERIALS

German Mechanical Devices. Development of Mechanical Handling Devices in Germany during and since the War, George F. Z[illegible] & Indus. Management, vol. 6, nos. 18, 22, 24 and 26, Nov. 3, Dec. 1, 15 and 29, 1921 pp. 514-515, 1 fig.; 645-646, 2 figs.; 706-707, 7 figs. and 760-761, 1 fig. Information resulting from author's visit to German industrial centers. Points out that band conveyor has been superseded by other devices owing to high cost of bands. Nov. 3: Improved automatic colliery tippler. Dec. 1: Mechanical removal of ashes from locomotives. Dec. 15: Latest developments in coal-face conveyors. Dec. 29: Pneumatic handling.

Textile Mills. Material Handling in the Textile Industry, R. M Gates. Management Eng., vol. 2, no 1, Jan. 1922, pp. 13-17, 8 figs. Shows types of electric trucks, belt conveyors, gravity conveyors, inclined elevators, etc., employed in textile mills. Points out importance of material handling.

HEAT

Recovery from Earth. Ground Heat as the Most Important Source of Energy (Die Erdwärme als wichtigste Energiequelle) Rauch u. Staub, vol. 12, no. 3, Dec. 1921, pp. 16-18. Review of developments in study of the recovery [illegible] from earth interior for technical purposes.

HEAT BALANCE

Electric Plants. Heat Balance of the Connors Creek Plant of the Detroit Edison Company, C. Harold Berry and F. E. Moreton. Mech. Eng., vol. 44, no. 1, Jan. 1922, pp. 22-25, 8 figs. Describes briefly apparatus in plant, followed by discussion of ideal operating conditions, and presents actual results. Includes table showing thermal balance sheet for April 1921.

HEAT INTERCHANGERS

Experiments With. Experiments with Heat Interchangers, F. Russell Bichowsky. Jl. Indus. & Eng. Chem., vol. 14, no. 1, Jan 1922, pp. 62-64, 3 figs. Discusses the Linde, Hampton, and Nelson types of interchangers.

HEAT PUMPS

Evaporators With. Experiences on Evaporators with Heat Pumps, E. Wirth. Mech. Eng., vol. 44, no 1, Jan. 1922, pp. 49-51, 5 figs. Points out that whereas until now investigations have been made only with regard to liquids with low-boiling point, data are now available on heavier liquids Account of author's experiences with heat pump operation. Translated from Zeit. des Vereines deutscher Ingenieure, vol. 65, no. 46, Nov. 12, 1921, pp. 1183-1186.

HEAT TRANSMISSION

Problems. Heat Transfer, W. H. McAdams and T. H. Frost. Jl. Indus. & Eng. Chem., vol. 14, no. 1, Jan. 1922, pp. 13-18, 2 figs. Problems arising in the field of heat transfer and rational method for studying them. Results of preliminary experiments to determine numerical value of coefficient of heat transfer between condensing vapors and a pipe.

HEAT TREATING

Plant Operation. The Complete Operation of a Modern Heat Treat Department, Thomas B. Fordham. Factory, vol. 28, no. 1, Jan. 1922, pp. 31-34, 6 figs. Method of control which has been successful in reducing scrap loss and bringing down manufacturing cost.

HEATING, FACTORY

Bleeder Steam. Using Bleeder Steam in Factory Heating, J. A. McGillivray. Power House, vol. 14, no. 22, Nov. 21, 1921, pp. 21-27, 11 figs. Bleeder type is especially furnished where low pressure steam is required for heating, in combination with electric motive power. Bleeder types are designed for a variety of conditions of operation, both in condensing and non-condensing units, or any combination of the two.

HEATING, STEAM

Equipment. Features of Central Steam Heat Plant Equipment, W. A. Scott. Elec. Rev., (Chicago), vol. 79, no. 21, Nov. 19, 1921, pp. 759-760, 1 fig. Underfeed stokers provide for boiler operation at 250 per cent of rated capacity; modern coal and ash handling apparatus reduces operating labour; water softener used to treat well water.

HIGHWAYS

Research. The Status of Highway Research, W. K. Hatt. Eng. News-Rec., vol. 88, no. 2, Jan. 12, 1922, pp. 62-64. Major developments in field of investigation cited. Census of research planned by Advisory Board on Highway Research of Nat. Research Council.

Wisconsin System. Developing a Highway Transportation System, A. R. Hirst. West. Soc. Engrs. Jl., vol. 27, no. 1, Jan. 1922, pp. 13-18 and (discussion) pp. 19-25, 11 figs. Describes creation of State Trunk Highway System of Wisconsin involving 5000 mi. of highway.

HYDRAULIC TURBINES

Castings, Making. Making Water Turbine Castings, H. E. Diller. Foundry, vol. 49, nos. 22 and 23, Nov. 15 and Dec. 1, 1921, pp. 873-878 and 920-925, 19 figs. Nov. 15: Describes molding the large scroll-case castings; skeleton patterns keep down expense of equipment. Dec. 1: Method of molding small runners with vanes of curved steel plate and larger sizes with cast-iron vanes.

Impulse Type. Caribou Power Plant Has World's Largest Impulse Wheel, W. M. White. Jl. Electricity & Western Industry, vol. 47, no. 12, Dec. 15, 1921, pp. 465-466, 4 figs. Describes machinery installed in Caribou plant of Great Western Power Co., having normal capacity of 30,000 hp. each under 1008-ft head, at 171 r.p.m.

REACTION. Hydraulic Reaction Turbines, D. J. McCormack. Elec. Jl., vol. 19, no. 1, Jan. 1922, pp. 11-16, 13 figs. Discusses runners, casing, bearings, shaft, gate mechanism, etc.

HYDRAULICS

EDDY CURVES. [illegible] for the Determination of Eddy Curves (Nouvelle méthode pour la détermination des courbes de remous), [illegible]. Le Génie Civil, vol. 79, nos. 23 and 24, Dec. 3 and 10, 1921, pp. 488-492 and 515-516, 7 figs. Reviews methods in use and develops formulas for an improved method which tests made show to be satisfactory.

LABORATORY. The Hydraulic Laboratory, S. G. Roberts. Sci. Am., vol. 126, no. 1, Jan. 1922, pp. 10-11, 5 figs. Describes equipment and experimental work done at hydraulic laboratory at Petty's Island, Pa.

I

ILLUMINATION

CALCULATION OF INTENSITIES. Illumination Calculations for Various Planes, J. H. Kurlander. Elec. Rev. (Chicago), vol. 79, no. 24, Dec. 10, 1921, pp. 885-887, 3 figs. Derivation of equation showing simple relations between illumination intensities, source candlepower, and dimensions that can be easily determined in the field or from room plans.

FACTORY. Factory Illumination. Eng. Production, vol. 3, no. 63, Dec. 15, 1921, pp. 570-571. Notes on installation of lighting systems. Discusses varieties of glass used for windows of industrial works, and different systems of artificial lighting, consisting of direct, semi-direct and indirect lighting.

IMPACT TESTING

PAVEMENTS. Tests of Impact on Pavements by the Bureau of Public Roads, C. A. Hogentogler. Pub. Roads, vol. 4, no. 7, Nov. 1921, 1-18 and 27, 67 figs. Reports on behaviour of various pavement slabs in terms of impact force which they sustained, forces being computed from space-time curves.

INDICATORS

STEAM-ENGINE. The Detection of Errors in the Steam-Engine Indicator. Power, vol. 55, no. 3, Jan. 17, 1922, pp. 103-105, 5 figs. Deals with most probable errors.

INDUSTRIAL MANAGEMENT

FACTORIES. Technical Service at the Factory (Les Services d'études dans les usines), Emm. La Langlois. La Vie Technique et Industrielle, vol. 3, no. 26, Nov. 1921, pp. 132-133. Preparation of new installations; improvements in material, tools and processes; study of upkeep and repairs; filing of information and documents on all matters.

GANTT CHARTS. How a Manager Uses Gantt Charts, Frank W. Trabold. Management Eng., vol. 2, no. 1, Jan. 1922, pp. 28-30. Discusses use of the Gantt load, idleness-expense, and man-record charts, some things they disclosed, and their value to executive.

INSPECTION SYSTEM. The Delco Inspection System—II and III. Machinery (Lond.), vol. 19, nos. 473 and 475, Oct. 20 and Nov. 3, 1921, pp. 71-75, 14 figs., and pp. 122-125, 12 figs. Typical examples of gaging fixtures used by Dayton Engineering Laboratories Co. in manufacture and inspection of company's product.

PLANNING. Departmental Collaboration, James Edgar. Eng. & Indus. Management, vol. 6, no. 24, Dec. 15, 1921, pp. 690-692. Explains scientific planning of output, which has become essential with introduction of quantity-producing methods, consequent upon development of automatic machine.

PROCESS CHARTS. Process Charts and Their Place in Management, Frank B. and L. M. Gilbreth. Mech. Eng., vol. 44, no. 1, Jan. 1922, pp. 38-41 and 70, 4 figs. Device for visualizing process as means of improving it. Authors point out place of process chart in management and present established working data used successfully in numerous working installations for many years; also its simplicity, field of application, its relation to standardization, etc.

PRODUCTION ORDER QUANTITY. Determining the Production Order Quantity, W. E. Camp. Management Eng., vol. 2, no. 1, Jan. 1922, pp. 17-18, 2 figs. Writer derives formula for determining production order quantity such that total cost per unit for setting up plus interest on stores investment will be [illegible]

SERVICE DEPARTMENT. Service Work As a Phase of Production, S. Harold Greene. Management Eng., vol. 2, no. 1, Jan. 1922, pp. 7-11. Outlines system of [illegible] as a [illegible] and integral part of production.

STORES CONTROL. Some Notes on Stores Control. Eng. & Indus. Management, vol. 6, no. 24, Dec. 15, 1921, pp. 682-684, 2 figs. Notes on systematic recording and disposal of defective parts.

SMALL FACTORIES. Management Problems of the Small Factory, Ernest Cordeal. Indus. Management, vol. 63, no. 1, Jan. 1922, pp. 43-49, 2 figs. Machines, tools and appliances.

Organization and Management of the Small Shop, E. W. Leach. Am. Mach., vol. 55, nos. 17, 19 and 22, Oct. 27, Nov. 10 and Dec. 1, 1921, pp. 671-673, 754-756 and 883-885. Oct. 27: Small shop office work; why bookkeeping is essential; classifications of entries; value of credit. Nov. 10: Going after business; cause and effect of readjustment; function of advertising. Dec. 1: Qualifications of successful executive; co-operation between producers and management; modern business ethics.

TOOL-ENGINEERING DEPARTMENT. How Tool Engineering Cuts Costs, Joseph Lannen. Indus. Management, vol. 63, no. 1, Jan. 1922, pp. 12-20, 9 figs. System of supervising jigs, fixtures, gages and other equipment. Describes methods that have given satisfactory results in process of ascertaining costs in tool-engineering department.

WORKSHOPS. Workshop Management (Le contrôle à l'atelier), C. B. Thompson. L'Outillage, vol. 234, no. 46, Nov. 17, 1921, pp. 1232-1233. Discusses scientific management and its various applications.

See also Taylor System; Time Study.

INDUSTRIAL ORGANIZATION

BRITISH WORKS. An Efficient Works System. Eng. Production, vol. 3, nos. 60, 61, 62, Nov. 24, Dec. 1, 8 and 15, 1921, pp. 493-498, 517-522, 539-544 and 557-562, 59 figs. Detailed description of successful organization and system in works of Barr & Stroud, Ltd., Glasgow, manufacturers of high-grade precision instruments.

KNITTING MILL. The Organization of Knitting Mills, Carle M. Bigelow. Management Eng., vol. 2, no. 1, Jan. 1922, pp. 37-42, 5 figs. Solving problem of labour control.

INDUSTRIAL RELATIONS

HUMAN FACTOR. The Human Factor in Industry—IV, Clarence H. Northcott. Indus. Management, vol. 63, no. 1, Jan. 1922, pp. 36-41. What industry owes workers as members of the community. Notes on wage principles; rate fixing; organization to guarantee fair wages; security against unemployment; work preparatory school; care for working conditions; vocational selection; etc.

IMPROVEMENT OF. Various Plans to Improve Industrial Relations, Ray Vance. Can. Foundryman, vol. 12, no. 8, Aug. 1921, pp. 32-35. Discusses human elements, stock selling plans, bonus plans, industrial democracy, shop committee plans, etc.

WORKMEN'S CONTROL. The Workman in Control (Le Contrôle ouvrier). La Métallurgie, vol. 53, no. 46, Nov. 17, 1921, pp. 2141-2142. Discusses attitude of workers, industrial democracy, consent of labour, etc.

INDUSTRIAL TRUCKS

ELECTRIC. The Electromobile. Motor Transport, vol. 33, no. 879, Jan. 2, 1922, p. 13, 3 figs. Describes a battery-propelled vehicle of the 1- and 2-ton and the 4- and 5-ton types, the latter having a four-wheel drive.

INSULATING MATERIALS

BREAKDOWN TESTS. Breakdown Tests on Insulating Materials, N. A. Allen. Elec. Rev. (Lond.), vol. 89, no. 2301, Dec. 30, 1921, p. 876, 3 figs. Describes a simple guard-ring method.

INSULATORS, ELECTRIC

PORCELAIN. The Manufacture and Testing of High Tension Porcelain Insulators, A. D. Allen. Elec. News, vol. 30, no. 16, Aug. 15, 1921, pp. 33-35, 3 figs. Describes processes involved in making and care essential in inspecting.

INTERNAL-COMBUSTION ENGINES

COMPOUND. Compounding the Combustion Engine, Elmer A. Sperry. Mech. Eng., vol. 44, no. 1, Jan. 1922, pp. 27-32 and 74, 14 figs. Presents results of research by author extending over series of years, during which it is claimed that not only has high-pressure principle been thoroughly established, but all important requirements have been worked out, and an engine embodying practically all advantages has been subjected to long continuous runs.

DEVELOPMENT. Internal Combustion Engine, Charles E. Lucke. Nat. Engr., vol. 25, no. 12, Dec. 1921, pp. 604-607. Rising importance of oil-injection type. Review of development.

See also [illegible] Engines; Automobile Engines; Diesel Engines; Oil Engines; Semi-Diesel Engines.

IRON

ELECTROLYTIC. Electrolytic Iron a Commercial Product, Bradley Stoughton. Iron Age, vol. 109, no. 1, Jan. 5, 1922, pp. 32-36, 5 figs. Eustis process compared with others. An ore instead of scrap as anode. Tests and properties, fields of usefulness.

L

LABORATORIES

[illegible] vol. 63, no. 1, Jan. 1922, pp. 26-29, 3 figs. How research laboratories assist business. Users of industrial laboratories.

LAKES

Regulating Level. Proposed Regulation of Lake Ontario. Can. Engr., vol. 41, no 26, Dec. 29, 1921, pp. 1 and 11-12, 4 figs. Studies by Canadian and U. S. Government engineers for International Joint Commission. Appendixes to report on improvement of St. Lawrence River from Lake Ontario to Montreal.

LATHES

[illegible] Ltd., Bredbury, England, which is said to be much more powerful than lathes [illegible]

Turret. Turret Lathe Tooling, J. F. Yeoman. Machy. (N. Y.), vol. 28, no. 5, [illegible] housings on foster turret lathes.

LEAD ALLOYS

[F]rary Metal. The Electrolytically Produced Calcium-Barium-Lead Alloys Comprising Frary Metal, William A. Cowan, L. D. Simpkins and G. O. Hiers. Chem. & Met. Eng., vol. 25, no. 26, Dec. 28, 1921, pp. 1181-1185, 13 figs. Equilibrium diagram and microstructure of barium-lead and calcium-lead alloys. Ternary alloy hardens and strengthens on aging; is hard at moderate temperature; can be melted without change in analysis, and is a very fine bearing metal. Paper, slightly condensed, read before Am. Electrochem. Soc.

LEATHER

Tanning. Nature and Essential Character of the Tanning Process and of Leather, Friedrich Knapp. Jl. Am. Leather Chemists Assn., vol. 16, no. 12, Dec. 1921, pp. 658-681. Discusses cleansing; tanning; tanning experiments with alum, aluminum sulphate, aluminum chloride, aluminum acetate, ferric chloride, stearic acid, rosin, picric acid, etc. Translated from Collegium, nos. 589 and 590, 133 and 166, 1919.

LIQUIDS

Corrosive, Handling. Anti-Corrosive Chemical Engineering Plant. Canadian Chemistry and Metallurgy, vol. 5, no. 12, Dec. 1921, pp. 341-342, 2 figs. Some English chemical equipment designed for special service in handling acids and cordoring liquids.

LOCOMOTIVES

Design. Modern Locomotive Engine Design and Construction—LXXVI. Ry. Engr., vol. 42, no. 503, Dec. 1921, pp. 458-463, 7 figs. Practical considerations affecting production of an economical form of coupling rod.

[illegible]

Mountain Roads. Shay Geared Locomotives for Mountain Roads. Ry. Age, vol. 71, no. 25, Dec. 17, 1921, pp. 1198-1210, 4 figs. 150-ton Shay for Greenbriar, Cheat & Elk R.R. High sustained tractive effort compared with Mikados.

Rebuilding. Rebuilding Old Locomotives, Carl B. Smith. New England Railroad Club, Dec. 13, 1921, pp. 207-214 and (discussion) 215-228. Discusses replacing of boilers, superheater equipment, cylinders, valve gears, frames, automatic fire doors, and other parts.

Superheater. Locomotives of the Pacific Type of the Midi Company. France (Note sur les locomotives Pacific à deux cylindres à simple expansion et surchauffe de la Compagnie des Chemins de Fer du Midi), M. Leboucher. Revue Générale des Chemins de Fer et des Tramways, vol. 40, no. 11, Nov. 1921, pp. 291-303, 7 figs., partly on supp. plate. Superheater, two-cylinder twin-action type. Complete specifications and data.

LUBRICANTS

[illegible] and Distribution. [illegible] F. C. Henn. Am. Mach., vol. 56, no. 1, Jan. 5, 1922, pp. 4-7. 10 figs. Oil pumped from tank cars to storage tanks; centrifugal machines separate used oil from chips; elaborate system of reclamation and distribution.

Viscosity and Friction. Viscosity and Friction, Winslow H. Herschel. Soc. Automotive Engrs. Jl., vol. 10. no. 1, Jan. 1922, pp. 31-41, 2 figs. Discusses viscosity effect in complete-film-lubrication regime; viscosity estimation at one temperature from observed viscosity at another temperature; friction testing of bearing metals; oiliness of lubricants; oil-friction testing machines; etc.

LUBRICATING OILS

Steam-Turbine. Essential Qualities of Oil for Steam Turbine Lubrication. J. Y. [illegible] 770-772, 3 figs Definition of viscosity of oil: tests required to determine quality [illegible]

The Viscosity of Steam-Turbine Oils, V. M. Hatch. Power, vol. 54, no. 26, Dec. 27, 1921, pp. 1011-1012. Factors controlling friction in bearings. Viscosity at operating temperature is said to be most important consideration.

M

MACHINE TOOLS

Drives. The Driving of Machine Tools, Hubert Bentley. Eng. & Indus. Manage- [illegible] and direct-gear drive in transmitting power, and advent of direct drive from lineshaft to single-pulley all-gear-driven machine.

Feeds and Speeds. Feeds and Speeds as Production Factors, Albert A. Dowd and Frank W. Curtis. Machy. (N.Y.), vol. 28, no. 5, Jan. 1922, pp. 381-383, 5 figs. [illegible] savings made possible by increasing rate of feed on a lathe; savings effected [illegible]

MACHINERY

Special and Automatic. When Is It Economical to Install Special and Automatic Machinery? A. L. DeLeeuv. Management Eng., vol. 2, no. 1, Jan. 1922, pp. 19-24, 1 fig. Includes chart showing various conditions met in grouping special machinery. Notes on determining costs under part-time operation; figuring value of machinery; single-purpose machines; operating automatic machinery in cycles; etc.

MALLEABLE CASTINGS

Foundry Problems. Pertinent Facts Concerning Malleable-Iron Castings, Enrique Touceda. Soc. Automotive Engrs. Jl., vol. 10, no. 1, Jan. 1922, pp. 53-61, 12 figs. Discusses foundry difficulties; casting defects; shrinkage and machinability; improvements in annealing-oven construction and operation.

MANGANESE STEEL

Electric. Manganese Steel Made in Electric Furnace, Larry J. Barton. Iron Age, vol. 109, no. 1, Jan. 5, 1922, pp. 4-8 and 109, 11 figs. Discusses melting practice for castings. Use of manganese steel scrap. Deoxidizing with manganese ore. Heat treatment.

Welding. Welding Manganese Steel, H. R. Pennington. Welding Engr., vol. 12, Dec. 1921, pp. 21-23 and (discussion) 23-24, 2 figs. Frogs and crossing layouts put in service at a fraction of cost of new installation. Gives table showing effect of varying quantities of manganese and carbon on physical quality of steel. Discusses are welding methods. Paper read before Am. Welding Soc.

MARINE STEAM TURBINES

Blading Failures. Low Pressure Turbine Blading Failures in Destroyers, D. F. Ducey. Jl. Am. Soc. Naval Engrs., vol. 33, no. 3, Aug. 1921, pp. 512-540, 39 figs. The turbines are of the impulsive type having five rows of moving blades. The first and second are of monel metal, the third, fourth and fifth chrome-vanadium and chrome-nickel steel. Describes failures in detail and gives illustrations.

MATERIALS

Thermal Conductivity of Wearing. Thermal Conductivity of Some Wearing Materials, Emily S. Rood. Physical Rev., vol. 18, no. 5, Nov. 1921, pp. 356-361. Results of measurements made with samples of wooden, cotton, and silk materials.

METALS

Colloidal State. Colloidal State in Metals and Alloys—I, Jerome Alexander. Chem. & Met. Eng., vol. 26, no. 2, Jan. 11, 1922, pp. 54-58. Molten metal. Shows that many of important phenomena of metals and alloys are due to colloidal state of subdivision, and that portion of the metal or alloy tends to remain in the colloidal state and exert a powerful influence upon physical properties of final solid magma.

Electrodeposition. The Electro-Deposition of Metals—VIII, W. E. Hughes. Beama, vol. 9, no. 6, Dec. 1921, pp. 555-562. Discusses electrodeposition of lead. Applications, properties, lead-plating solutions, and microstructure.

Fatigue. Fatigue of Metals Under Repeated Stress, Moore and Kommers. Chem. & Met. Eng., vol. 25, no. 25, Dec. 21, 1921, pp. 1141-1144, 6 figs. Results of experiments. Carbon steels will not fail by "fatigue" if stressed below a definite amount, quickly determined by measuring heat generated in specimen during test.

METALLOGRAPHIC TESTING. Metallographic Testing. U. S. Bur. of Standards Circular, no. 42, Aug. 29, 1921, 11 pp., 4 figs. Study of fundamental conditions, structure, constitution, and treatment of meatls and alloys. Discusses different lines of metallographic testing carried out by Bur. of Standards.

STRUCTURE. Structure and Related Properties of Metals. U. S. Bur. Standards Circular, no. 113, Sept. 7, 1921, 104 pp., 71 figs. Discusses general nature of structure of metals, methods for revealing it, and dependence of properties of metals as a whole upon its structural features. Describes methods in use for revealing chemical unhomogeneity, crystalline heterogeneity, physical unsoundness, and mechanical nonuniformity. Discusses principles underlying action of etching reagents; conditions affecting structure, chemical composition, application of heat, and mechanical working of metal; and dependence of mechanical properties and chemical behavior upon structure condition of material.

SURFACE FLAWS. Influence of Surface Flaws on Strength of Metals, Horace C. Knerg. Automotive Industries, vol. 45, no. 25, Dec. 22, 1921, pp. 1216-1217, 6 figs. Shows that surface flaws have a pronounced effect upon metals subjected to fatigue through repeated stresses, but that such flaws do not always decrease strength under constant load conditions.

TESTING. Testing Metal by Repeated Stress, H. F. Moore and J. B. Kommers. Iron Trade Rev., vol. 69, no. 25, Dec. 22, 1921, pp. 1623-1630, 7 figs.; also Eng. News-Rec., vol. 88, no. 2, Jan. 12, 1922, pp. 76-78, 3 figs. Fatigue investigation is broadened to include variety of steels and several heat treatments. Results show definite relation between Brinell hardness and endurance limit. Rise of temperature test used to predict limit. (Abstract) Bul. no. 124, Engineering Experiment Station, University of Illinois.

METRIC SYSTEM

ENGLISH SYSTEM VS. A Digest of "The Metric versus the English System of Weights and Measures." Nat. Indus. Conference Board, Special Report No. 20, Dec. 1921, 11 pp. Presents facts and arguments on whether metric system should be substituted for English system of weights and measures in the United States.

MILLING CUTTERS

SHARPENING. How to Sharpen Milling Cutters, Fred. B. Jacobs. Abrasive Industry, vol. 2, no. 12, Dec. 1921, pp. 395-401, 19 figs. Cutter grinding operations are expedited by using a machine designed for the purpose; form cutters required careful attention.

MILLING MACHINES

MANUFACTURING OPERATIONS. Manufacturing Operations on Milling Machines, Robert Mawson. Am. Mach., vol. 55, no. 25, Dec. 22, 1921, pp. 996-997, 10 figs. Special toolholders for facing four-step cones. Fixtures and tools_for machining milling machine heads. A unique angle-facing fixture.

MOLDING METHODS

FLOUR-MILL ROLLS. Molding and Casting Chilled Flour-Mill Rolls, G. O. Vair. Can. Foundryman, vol. 12, no. 8, Aug. 1921, pp. 20-21 and 25, 5 figs. Designs for molds; casting; machining.

MOTORSHIPS

PASSENGER LINER. The First Motor Passenger Liner, A. P. Chalkley. Mar. Eng., vol. 17, no. 1, Jan. 1922, pp. 31-36, 11 figs. Describes the Aba assigned to Liverpool-Africa route. Gross tonnage, 8,000; indicated horsepower, 6,400.

N

NICKEL

PLANT AND OPERATIONS. The International Nickel Co. of Canada Ltd., A. R. R. Jones. Iron & Steel of Can., vol. 4, no. 10, Nov. 1921, pp. 269-271, 4 figs. Describes its plants and operations; Monel metal and its uses.

NOZZLES

[illegible] FLOW. The Use of Nozzles in Measuring Pulsating Flow. [illegible] vol. 26, no. 1, Jan. 4, 1922, pp. 32-34, 3 figs. Discusses [illegible] of nozzles for measuring differential pressure unless the flow curve is known as a function of time.

O

OIL FIELDS

NORTHERN CANADA. The Mackenzie Oil-field of Northern Canada, T. O. Bosworth. [illegible] Petroleum Technologists Jl., vol. 7, no. 28, Oct. 1921, pp. 276-291 and [illegible] 291-297, 9 figs. Discusses transportation to oil-field, problem [illegible]ing the oil, stratigraphy and geology, occurrence of oil, and exploit-[illegible]

OIL FUEL

BURNING. The Burning of Oil Fuel and the Arrangement of Machinery Necessary, together with Observations and Comments Drawn from Actual Conditions, A. Keens. Trans. Inst. Mar. Engrs., vol. 33, Oct. 1921, pp. 337-363 and (discussion) 363-375, 12 figs. Discusses advantages of fuel oil; storage spaces; oil fuel pumps; piping, holders and burners; furnaces and combustion chambers; pumping arrangement; etc.

GLASS INDUSTRY. The Application of Oil Fuel in the Glass Industry. Jl. Soc. Glass Technology, vol. 5, no. 19, Oct. 1921, pp. 286-300 and (discussion) 300-307. Symposium. Comparison with gas firing.

INJECTION AND COMBUSTION. Injection and Combustion of Fuel-Oil—VI and VII, C. J. Hawkes. Motorship, vols. 6 and 7, nos. 10 and 2, Oct. 1921 and Jan. 1922 p. 820, 4 figs. and p. 34, 6 figs. Experiments with solid-injection and air-blast in marine Diesel engines.

MEXICAN. The Production and Combustion of Mexican Fuel Oil—VIII, J. M. Pettinbell and J. R. Carlson. Combustion, vol. 5, no. 6, Dec. 1921, pp. 254-257 6 figs. Discusses economy in oil burning operation.

STEAM GENERATION. Liquid Fuel and Its Application for Steam Generation. J. H. Anderson. Inst. of Mar. Engrs. Trans., vol. 33, Dec. 1921, pp. 521-563 and (discussion) 563-568, 27 figs. Discusses fractional and continuous distillation and use of fuel oil, Describes a number of oil fuel heaters and systems of fuel-oil burning.

SULPHUR IN. Effects of Sulphur in Fuel Oil, Allen F. Brewer. Power, vol. 55, no. 2, Jan. 10, 1922, pp. 50-51. States that presence of sulphur is detrimental, but its deteriorating effect can be largely avoided by adopting proper precautions.

OILS

VEGETABLE, MACHINES FOR PRODUCING. Machinery for Vegetable Oil Production. Eng. Rev., vol. 35, no. 6, Dec. 1921, pp. 182-187, 8 figs. Reviews development of these machines and compares the various designs.

OPEN-HEARTH FURNACES

FUELS USED. Fuels Used in Open-Hearth Practice, Edwin F. Cone. Iron Age, vol. 108, no. 25, Dec. 22, 1921, pp. 1589-1591. Analysis of 1920 ingot and castings production. Producer gas chiefly employed for ingots and oil for castings. Results of answer to questionnaire sent to producers of open-hearth steel ingots and steel castings.

OXY-ACETYLENE WELDING

BRONZE CONDENSER SHEETS. Bronze Condenser Sheets, H. I. Walsh. Welding Engr., no. 12, Dec. 1921, pp. 27-28 and 40, 7 figs. Gas welding gives practical solution of problem arising from increase in size of ships. Paper read at Internat. Acetylene Ass. Convention.

P

PAPER

ENGINE SIZING. Engine Sizing of Paper. Paper, vol. 29, no. 14, Dec. 7, 1921, pp. 9-15. Discusses chemical reactions which take place when alum is added to a beater furnished with milk of rosin, and concludes that free rosin is the most active sizing agent, though aluminum and sodium resinates play apart. Translated from Le Moniteur de la Papeterie Française.

PAPER MILLS

COSTING. Main Elements of Paper Mill Costing, L. W. Farrow. Paper, vol. 29, no. 12, Nov. 23, 1921, pp. 24-28. Cost systems for fine paper mills and some fallacies in costing.

PAVEMENTS, ASPHALT

SHOVING. Causes of Shoving of Asphalt Pavements, Prevost Hubbard. Good Roads vol. 61, no. 21, Nov. 23, 1921, pp. 233-235. Co-operative investigations being carried on by U.S. Bur. Pub. Roads and several cities to determine causes of shoving under traffic. Paper presented before Am. Soc. Mun. Improvements.

PETROLEUM

REFINING. General Oil Refining Practice, C. D. Dean. Eng. Inst. Can. Jl., vol 5, no. 1, Jan. 1922, pp. 3-10. Selection of refinery site; boiler plant and pumping requirements, details of distillation and treatment processes for oils, pitches and asphalts; storage; fire protection precautions; railway trackage and wharf requirements.

PHOTOGRAPHY

Rendering Objects in Relief. [illegible] de M. Louis Lumière. [illegible] no. 27, Dec. 1921, pp. 225-227, 8 figs. [illegible] Louis Lumière of rendering objects in relief.

PIERS

Masonry. Eccentric Pressure on Piers of Pressure-Resisting Materials. [illegible] Aristide Giannelli. Giornale del Genio Civile, vol. 59, Aug. 31, 1921, pp. 1921, pp. 497-513, 16 figs. Makes calculations for masonry piers of rectangular section.

PILES

Resistance. Resistance of Piles. [illegible] Annales des Ponts et Chaussées, vol. 4, July-August 1921, pp. 5-67, 11 figs. Discusses calculation of load in the light of recent experiments, effect of dimensions of pile, and weight of pile driver.

PIPE, STEEL

Hammer-Welded. Hammer-Welded Steel Pipe—How It Is Made and Wherein It Excels. Raw Materials, vol. 4, no. 11, Nov. 1921, pp. 384-391, 11 figs. Discusses advantages over butt-weld and lap-weld methods, and methods used by Nat. Tube Co.

PIPE, WROUGHT-IRON

Chart for. Wrought Pipe Data. Sanitary & Heat. Eng., vol. 96, no. 14, Dec. 30, 1921, p. 395. Chart containing valuable information for the sanitary and heating engineer.

PISTONS

Machining Castings and Rings. How a British Foundry Specializes, H. Cole Estep. Foundry, vol. 49, no. 22, Nov. 15, 1921, pp. 879-887, 22 figs. Describes English methods of making piston castings and pots for piston rings.

PLANERS

Testing. Planing Machine Studies. Engineering vol. 112, no. 2922, Dec. 30, 1921, p. 886. Results of experimental work carriedout in Germany by G. Schlessinger on a horizontal planing machine, driven by electric motor running at 160 r.p.m. with toothed gear and belting. Various improvements were tested and it was possible to greatly reduce power absorbed and almost completely overcome power fluctuations. Translated from pamphlet by G. Schlessinger and M. Kurrein.

POWER

Costs. How to Follow Up Power Costs—III, N. A. Craigue. Indus. Management, vol. 63, no. 1, Jan. 1922, pp. 55-59, 1 fig. Various methods of distribution. Meters may be used to actually measure power as consumed; cost rate applied, and final cost obtained is charge against product.

POWER FACTOR

Electric Systems. The Power Factor of Electric Systems ("Cos Y"). Siemens-Zeit., special no., Nov. 1921, 84 pp. 90 figs. Contains eight articles as follows: Origin and Action of Wattless Currents in A.C. Plants; by R. Rudenberg. Measurement of Wattless Current and Power Factor, by Georg Keinath. Electric Meters for Wattless Current and Their Use for Calculating Electric Energy, by W. V. Krukowski. Measures for Improvement of Power Factor of Electrical Plants, O. Burger. Improvement of Power Factor on Lines of the Siemens Works in Siemensstadt, chr. Müller. Parallel Operation of Power Plants, O. Burger. A Noteworthy Example of Power-Factor Improvement on a Large Distributing System. A. Hajek. Bibliography.

Integrating Wattless Power. Three-Phase Wattless Power, G. W. Stubbings. Beama, vol. 9, no. 6, Dec. 1921, pp. 550-554, 9 figs. Some methods of integration without the use of special meters.

POWER PLANTS

Design. Developments in Power Station Design. Engineer, vol. 132, nos. 3441, 2443 and 3444, Dec. 9, 23 and 30, 1921, pp. 613-614, 5 figs., partly on supp. plate; 668-669, 3 figs.; 702-704, 10 figs. Dec. 9: Describes extensions being made to boilerhouse of the Neasden power station of Metropolitan Ry., by John Thompson Water-Tube Boilers, Ltd., Wolverhampton. Dec. 23: 12,000-kw. turbo-generator installed at Neasden power station, and other important additions. Dec. 30: Application of airheaters to central-station boilers.

Modern European Tendencies in Power-Plant. Design, A. W. H. Griepe. Power, vol. 55, no. 2, Jan. 10, 1922, pp. 54-56. European tendency is now to supply large cities at high voltage from large generating stations near mines, and gradually to shut down small, inefficient local plants. Notes on modifications in boiler proportions, types of boilers in use, boiler tubes and superheaters, economizers, stokers, cinder and soot disposal, preheating of air, use of low-grade fuels, etc. The Bone-Schanabel surface-combustion process in Germany. Only horizontal types of turbines used.

Maxim Silencers, Use of. The Maxim Silencer in the Power Plant. Power, vol. 55, no. 3, Jan. 17, 1922, p. 91, 3 figs. Describes use of such silencers, patents [illegible] steam safety valves, air hoists, steam and air discharges from special apparatus.

Progress in 1921. The Year's Progress in the Power Plant Field. Power, vol. 55, no. 1, Jan. 3, 1922, pp. 2-14, 11 figs. Boiler efficiencies of 90 per cent when burning pulverized coal, seven notable steam plants put into operation, unusual interest in hydroelectric development, 220,000-volt electric power equipment; are some of outstanding features of 1921.

PRESSES

Hydraulic and Hand-Forcing. Hydraulic and Hand Forcing Presses in a Locomotive Shop, J. V. Hunter. Am. Mach., vol. 56, no. 3, Jan. 19, 1922, pp. 108-109, 5 figs. Horizontal press for forcing brasses in boxes. Method of using air pumps for boosting pressures. Self-contained portable press

PROFILING MACHINES

Fixtures. Some Examples of Fixtures Used on Profiling Machines, J. M. Henry. Am. Mach. vol. 55, no. 26, Dec. 29, 1921, pp. 1040-1043, 11 figs. Points out that with suitable fixtures, machines may be used for many different operations and two or more operations may be performed at one setting.

PULVERIZED COAL

Air Furnaces. Apply Powdered Coal to Air Furnace, Pat Dwyer. Foundry, vol. 49, no. 24, Dec. 15, 1921, pp. 955-962, 15 figs. Malleable-iron melting furnaces and annealing ovens have been converted from hand-firing to use of powdered coal without involving radical changes in design.

Application to Boilers. Application of Pulverized Coal to Boilers, J. W. Fuller. Trans. Am. Inst. Min. & Metallurgical Engrs., no. 1106-C, 1921, 4 pp. Gives a few instances of many successful installations burning pulverized coal that were made under various types of boilers and using many fuels. Abstract of paper in Min. & Metallurgy, no. 180, Dec. 1921, pp. 35-36.

Metallurgical Furnaces. Powdered Fuel, J. S. Atkinson. Iron & Coal Trades Rev., vol. 103, no. 2805, Dec. 2, 1921, p. 802. Recent developments in connection with firing of metallurgical furnaces. Relative costs of gas firing and powdered fuel firing, cost of powdering, etc. (Abstract.) From Fuel Economy Rev.

Preparation and Combustion. The Preparation, Transportation, and Combustion of Powdered Coal, John Blizard. Canada Dept. of Mines, no. 564, 1921, 131 pp., 42 figs. Discusses distribution; feeder, mixers and burners: advantages and disadvantages; use for steam raising costs of preparing and delivering to furnace; operating and repair costs; etc.

Small-Plant System. Pulverized-Coal System for Small Plants. Power, vol. 54, no. 26, Dec. 27, 1921, pp. 1016-1017, 2 figs. System consisting of self-contained crusher and blower allows pulverized coal to be used in small plants.

Turbo Pulverizer. The Turbo Pulverizer. Iron & Coal Trades Rev., vol. 103, no. 2807, Dec. 16, 1921, p. 877, 1 fig. Describes apparatus built by The Powdered Fuel Plant Co., Ltd., Lond., which is a pulverizing mill and fan combined.

PUMPS

Mammoth. Mammoth Pumps. Eng. Progress, vol. 2, no. 12, Dec. 1921, pp. 277-278, 3 figs. Describes construction and operation of the pump and its application to raising water, chemical liquids, and solid substances that can be moved in currents of fluids.

PUMPS, CENTRIFUGAL

Parallel Operation. Operating Pumps or Fans in Parallel, J. C. Hobbs. Power, vol. 55, no. 2, Jan. 10, 1922, pp. 58-60, 6 figs. Discusses problems encountered in parallel operation of centrifugal pumps and explains why pumps must have correct characteristics.

PYROMETRY

Liquid-Fuel-Fired Boilers. Pyrometry of Boilers Fired with Liquid Fuel, E. C. Reed. Eng. & Indus. Management, vol. 6, no. 26, Dec. 29, 1921, pp. 743-746, 4 figs. Describes the Foster fixed focus pyrometer and its application. Writer claims that expense of installation of pyrometer system may be saved many times over in year.

R

RAILS

Reclaiming Worn-Out. Worn-Out Rails—Their Resurrection from Uselessness to Usefulness Raw Material, vol. 4, no. 11, Nov. 1921, pp. 392-395, 11 figs. Describes opeartions at Sweet's Steel Co.'s rail reclamation plant, Williamsport, Pa.

[illegible] Rail Manufacture, Cecil J. Allen. Ry. Engr., vol. 42, no. 503, Dec. 1921, pp. 468-470, 3 figs. Comparison of results [illegible] with rails rolled from sink-head and ordinary ingots respectively.

[illegible] Street Car Rails (L'Usure des rails de chemins de fer et de tramways), J. Gouttier. Revue Universelle des Mines, vol. 11, no. 5, Dec. 1, 1921, pp. 524-543, 12 figs. Describes Sandberg process of [illegible] and its successful application to rails.

WEAR. Causes of Premature Wear of Rails (Les causes de l'usure prématurée des rails). Le Génie Civil, vol. 79, no. 21, Nov. 19, 1921, pp. 429-433, 26 figs. Discusses cracks, fissures, segregation, etc., in rails; effect of tempering, and [illegible]

RAILWAY CONSTRUCTION

CANADA. Development of Canadian Railway Construction, H. K. Wicksteed. Can. Engr., vol. 42, no. 1, Jan. 3, 1922, pp. 104-108. Describes early trade routes and economic conditions which resulted in construction of railways in Canada. Problems solved by engineers when locating trans-continental road. Paper before Am. Assn. for Advancement of Sci.

GRADE REDUCTION. Justifying Expenditures for Grade Reductions, George J. Ray. Ry. Age, vol. 71, no. 26, Dec. 24, 1921, pp. 1243-1250, 5 figs. Shows that the construction of the Clarks Summit-Hallstead line is fully warranted by operating results. (Abstract.) Paper read before Western Soc. Engrs.

RAILWAY ELECTRIFICATION

ADVANTAGES. Railway Electrification, Vincent L. Raven. North-East Coast Instn. Engrs. & Ship-builders, advance paper, no. 3195—P for meeting, Dec. 16, 1921, 24 pp., 9 figs., partly on supp. plate. Deals with advantages which may result from substitution of electric for steam locomotive operation. See also Engineer, vol. 132, nos. 3443 and 3444, Dec. 23 and 30, 1921, pp. 673-674 and 711, 713, 5 figs., partly on supp. plate.

STEEL PLANT. Electrification of Steel Plant Railroad, R. B. Gerhardt. Iron Age, vol. 108, no. 26, Dec. 29, 1921, pp. 1663-1666. Difficulties are said to include protection of third rail from hot metal spills. Saving in cost 50 per cent. Investment offset by low operating cost. Paper presented before Assn. Iron & Steel Elec. Engrs.

SUPERPOWER PLAN. Electric Traction Proposed for 11 Railroads. Ry. Elec. Engr., vol. 12, no. 11, Nov., 1921, pp. 409-414, 9 figs. Discusses Superpower Survey report transmitted to the president containing plan providing for the interconnection of a large number of existing plants. By consolidating power supply, electric operation could be made to show saving of 14 per cent.

RAILWAY OPERATION

NORTH EASTERN RAILWAY. Surveys, Diagrams and Other Records Prepared by the Engineers Department of the North Eastern Railway, Conrad Grible. Ry. Gaz., vol. 35, no. 23, Dec. 2, 1921. pp. 841-848, 7 figs., partly on supp. plate. Line and siding diagrams as substitutes for surveys. Co-ordination of field work in measuring distances for statistical, operating and commercial purposes. Systematic recording of strength of bridges. Percentage system or recording equivalent weights of locomotive.

TRAIN DISPATCHING. Management of Single Track Lines in Great Britain (Note sur l'exploitation des lignes à voie unique dans le Royaume-Uni). Revue Générale des Chemins de Fer et des Tramways, vol. 40, no. 11, Nov. 1921, pp. 304-318, 14 figs. Discusses ticket, tablet, and token systems of train dispatching, and the various apparatus for exchanging used in connection with them.

RAILWAY SHOPS

MONTREAL, CAN. A Railroad Shop Organized for Efficiency. Machy. (N.Y.), vol. 28, nos. 4 and 5, Dec. 1921, and Jan. 1922, pp. 291-293 and 389-392, 8 figs. Description of Angus shops of Can. Pac. Ry. Co., Montreal, Canada, and equipment and methods employed.

RAILWAY SIGNALLING

[illegible] Interlockings at Jacksonville Terminal, C. J. Kelloway, Ry. [illegible] 14, no. 12, Dec. 1921, pp. 462-468, 18 figs. Developments in the construction of a large electro-pneumatic and two electro-mechanical [illegible] circuits.

RAILWAY SWITCHES

[illegible] Operated Equipment for Car Handling, R. M. Kintzing. [illegible] 79, no. 21, Nov. 19, 1921, pp. 773-775, 6 figs. Inter-[illegible]hes employed to assure proper sequence in cycle [illegible] in plant capacity secured [illegible]

[illegible] 2, Feb. [illegible] ption of road surveyed, constructed and oper- [illegible]

DEVELOPMENT 1921. Central Railroad Developments During the Year. Ry. Age, vol. 72, no. 1, Jan. 7, 1922, pp. 9-154, 89 figs. Articles on regulation of securities, labor situation, federal valuation, railroad accounts with the government, profit of railroads from lower material costs, recent tendencies in loconotive development, special types of cars introduced in 1921, maintenance-of-way, cutting freight loss and damage claims, accounting, equipment conditions, electrical developments, repair-shop and engine-house development, chronological review of year's activities. Also contains articles on railway statistics, including locomotive, freight-car and passenger-car market.

MONORAIL SUSPENDED LINE. Monorail Suspended Railroad Tracks and Canal-Boat Haulage (Système de voies suspendues monorails et système de halage des bateaux), M. Mahl. Bul. de la Société Française des Electriciens, vol. 1, no. 7, July 1921, pp. 337-368, 13 figs. Discusses a projected monorail line from Paris to Nice according to the Barmen-Elberfeld system, but with maximum speed of 300 km. per hr., also power transmission and boat haulage as side issues.

REFRACTORIES

RESISTANCE. Resistance Tests on Refractory Products under Load at Different Temperatures, V. Bodin. Quarry & Surveyors' & Contractors' Jl., vol. 26, no. 297, Nov. 1921, pp. 438-440, 3 figs. Results of tests, and table of crushing loads in kg.-cm. (Abstract.) Paper read before Ceramic Soc.

REFRIGERATING MACHINES

CARBON-DIOXIDE. Carbon-Dioxide Refrigerating Machine, H. J. Macintire. Power vol. 55, no. 1. Jan. 3, 1922, pp 24-26, 3 figs. Relative advantages of carbon dioxide *vs.* ammonia as refrigerating medium, in which pressure range, cooling-water limitations, horsepower per ton, relative size and construction are considered.

REFRIGERATING PLANTS

TEMPERATURES AND PRESSURES. Working Temperatures and Pressures in the Refrigeration Plant, W. H. Motz. Power, vol. 54, no. 26, Dec. 27, 1921, pp. 1005-1007, 3 figs. Notes on suction pressures and temperatures; discharge temperatures and pressures; use of thermometers.

RESEARCH

FAN INDUSTRY. Relation of Research to the Fan Industry. Am. Soc. Heat. & Vent. Engrs. Jl., vol. 27, no. 9, Dec. 1921, pp. 873-881. Research in the Heating and Ventilating Field, by J. I. Lyle; and Research as a Business Proposition, by F. R. Still.

ROLLING MILLS

ADJUSTABLE-SPEED MOTORS. Adjustable Speed With Motor Driven Mills, K. A. Pauly. Iron Age, vol. 108, no. 25, Dec. 22, 1921, pp. 1595-1598 and (discussion) pp. 1598-1600, 11 figs. Describes two satisfactory systems, with comments on their relative characteristics and particular work for which each is most adaptable. (Abstract.) Paper read before Engrs.' Soc. West. Pa.

CONTINUOUS. Continuous Rolling-Mills, John W. Shepherdson. Engrs.' Soc. of Western Pa. Proc., vol. 37, no. 4, May 1921, pp. 221-252 and (discussion) 253-257, 15 figs. Discusses advantages of continuous rolling process, and describes the various types of continuous mills, viz., billet mills, sheet-bar mills, wire-rod mills, mills for rolling flat finished products, merchant mills, etc.

FRICTION. Friction in Rolling Mills, William F. Parish. Iron Age, vol. 108, no. 26, Dec. 29, 1921, p. 1661. Effects of proper lubrication shown in reduced power losses. (Abstract.) Paper read before Am. Soc. Lubrication Engrs.

PRODUCTION AND YIELD. Production and Yield of Rolling Mills, Joseph F. Shadgen. Iron Age, vol. 109, nos. 1 and 2, Jan. 5 and 12, 1922, pp. 43-46 and 151-152, 1 fig. Jan. 5: Their present state of development. Useful operating data Losses which should be lessened. European practice leads in yield. Jan. 12: Dependence of material yield on oxidation and on bloom and billet cropping Temperature limitations are said to govern reheating.

SEMI-CONTINUOUS BAR. Semi-Continuous Bar Mill for Alloy Steel, F. L. Prentiss. Iron Age, vol. 109, no. 2, Jan. 12, 1922, pp. 141-144, 5 figs. Cooling equipment embodies inclined escapement and horizontal notched bed features. Flat spring steel is self-annealed in packs.

TANDEM ROLLING. Tandem Rolling of Cold-Rolled Steel. Iron Age, vol. 109, no. 3, Jan. 19, 1922, pp. 211-213, 7 figs. Special equipment developed for this purpose, including rolls and their housings, wire straighteners, edge rolls Turk's head and cross slides.

RESERVOIRS

OUTFLOW, CALCULATION OF. Computing Reservoir Outflow and Height from Inflow and Capacity, J. C. Stevens. Eng. News-Rec., vol. 87, no. 25, Dec. 22, 1921, pp. 1031-1032, 1 fig. Refers to method outlined by Prof. Pardoe in same journal (Jan. 20, 1921, p. 114). and claims that method here described is much simpler.

RIVERS

ICE GORGING. Winter Overflow from Ice Gorging on Shallow Streams, J. C. Stevens. Proc. Am. Soc. Civ. Engrs., vol. 47, no. 10, Dec. 1921, pp. 583-602, 11 figs. Deals with ice gorge occurring during coldest part of winter on streams too turbulent to permit formation of crystalline surface ice, but frazil and anchor ice are formed in such quantities that stream becomes viscuous mixture, resulting in rise of water and causing overflow. Discusses increasing flow of such streams during winter months by release of artificially stored water.

ROAD CONSTRUCTION

Handling Traffic During [illegible] Paul D. Sargent. Eng. News-Rec., vol. 88, no. 2, Jan. 12, 1922, pp. 64-65. Detouring is said to add 25 per cent [illegible] remedy.

ROAD ROLLERS

Three-Wheel Motor. Three-Wheel Water-Ballast Motor Road Roller. Engineering, vol. 112 no. 2922, Dec. 30, 1921, pp. 884-885, 6 figs. Describes new model produced by Barford & Perkins, Ltd., Peterborough, England. Nominal weight is 10 to 13 tons, and by placing engine at rear, a wheelbase of only 9 ft 9¼ in. has been obtained.

ROADS

Design. Safety and Beauty as Factors in Road Design, A. R. Hirst. Eng. & Contracting, vol. 57, no. 1, Jan. 4, 1922, pp. 20-23. Discusses fundamentals of [illegible]

Design. What 1921 Developed in Paved Road Design. Eng. News-Rec., vol. 88, bo. 2, Jan. 12, 1922, p. 61. Heavier and more reinforcement in concrete slabs. Macadam roads widened by concrete borders. Split slabs used in wider concrete roads.

[illegible] al design of rigid slab roads made possible by research conducted during two years by Division of Highways. (Abstract.) Paper read before Highway [illegible]

ROADS, CONCRETE

Testing. Variety of Movements Occur in Concrete Test Highway. Eng. News-Rec., vol. 87, no. 26, Dec. 29, 1921, pp. 1048-1051, 8 figs. Results of tests on roadway built near Pittsburg, Cal. Cracks in pavement come on crests of longitudinal waves. Edges curve up in daytime and down at night. Test continuing.

ROADS, MACADAM

Bituminous Penetration Work. 12 Years' Experience with Bituminous Penetration Work on Kansas City Boulevards and Park Roads. Fred Gableman. Eng. News-Rec., vol. 88, no. 2, Jan. 12, 1922, pp. 54-57, 2 figs. Review of practice since 1910 when oil binder was first tried on macadam roads. Asphalt now favored. Maintenance costs given.

ROCK DRILLS

Test of Drill Steel. Results of Rock Drilling Tests in the Tri-State Mining District. Eng. & Contracting, vol. 56, no. 25, Dec. 21, 1921, pp. 568-569. Account of tests conducted by Bur. of Mines co-operating with Missouri School of Mines [illegible] Results show that ⅛-in. gage changes and 24-in. changes in steel lengths are best for conditions in district under investigation when using 1¼-in. steel.

RUBBER

Stress-Elongation Curve. The Stree-Elongation Curve of Vulcanized India-Rubber, Emil Hatschek. Jl., Soc. Chem. Industry, vol. 40, no. 21, Nov. 15, 1921, pp. 251T-253T, 3 figs. Compares curves for samples of a definite rubber-sulphur mixture cured for definite lengths of time, and deduces formulas.

Testing. The Testing of Rubber Goods. U. S. Bur. of Standards Circular, no. I, 38, Sept. 28, 1921, 127 pp., 47 figs. Gives methods used at Bureau in testing of rubber goods. Describes various physical tests commonly applied and machines used for this purpose, many of which were designed in Bureau. Data are given showing effect of various factors on tensile properties of rubber. Effect of temperature on physical tests. Brief outline of methods of collecting crude rubber and processes used in manufacture of various rubber articles.

S

SCIENTIFIC MANAGEMENT

See *Industrial Management*.

SCREWS

Efficiency. Efficiency of Screws, C. D. Albert. Sibley Jl. of Eng., vol. 36, no. Jan. 1922, pp. 2-3, 1 fig. Comparison of correct and approximate expressions.

SEMI-DIESEL ENGINES

Hydroelectric Plant. A Combined Hydro and Semi-Diesel Plant at Minnedosa, Manitoba. Power, vol. 55, no. 3, Jan. 17, 1922, pp. 92-93, 2 figs. Semi-Diesel engines installed in hydroelectric plant to carry loads during periods of low water.

SEWAGE

Gas Production. Power from Sewage Gas. Engineer, vol. 132, nos. 3442 and 3443, Dec. 16 and 23, 1921, pp. 642-643 and 669-671, 5 figs. Dec. 16: Describes the W[illegible] sewage treatment system, patented in 1917, with special arrangements for production of gas from sewage, and improved method of purifying sewage. It is claimed system may be applied to various shapes and types of tanks. Dec. 23: Discusses what has been done in Australia and in England with use of this system.

SEWAGE DISPOSAL

Dewatering Sludge. Centrifuges for Dewatering Sludge, T. Chalkley. Pub. Works, vol. 51, no. 25, Dec. 17, 1921, pp. 461-464, 1 fig. Sludge used by farmers in Germany dewatered by filter presses and centrifuges, the latter different from any heretofore used in this country. Paper presented before Sanitary Eng Section, Am. Pub. Health Assn.

Marsh Gas from Sludge. Utilizing Gas from Sewage Sludge as Motive Power, John D. Watson. Eng. News-Rec., vol. 87, no. 26, Dec. 29, 1921, pp. 1062-1064. Describes experiments and experiences which are calculated to si[illegible] gas which is formed by organisms acting upon decaying vegetable and other organic substances. Discusses nature and power of this gas and shows what it can be made to do when under control. See also Can. Engr., vol. 42, no. 2, Jan. 10, 1922, pp. 127-129, 1 fig.

SHEET-METAL WORK

Elbows. New Machine Making Two Elbows a Minute. Sheet Metal Worker, vol. 12, no. 25, Jan. 6, 1922, pp. 854 and 855, 2 figs. Describes Lyon-Conklin elbow machine which turns blank sheets into elbows.

SHIPS

Ice Breakers. The Design of Ice-Breakers, Alexander Kari. Shipbldg. & Shipg. Rec., vol. 18, no. 25, Dec. 22, 1921, pp. 802-804, 4 figs. Discusses statical and dynamical ice-breaking and its application to design.

SHOVELS

Electric. Electric Shovels in Construction of Power Canal. Eng. World, vol. 20, no. 1, Jan. 1922, pp. 17-19, 5 figs. Describes advantages, including large capacity, speed of operation, reduced labor charges, continuity of operation and reliability.

SILICA BRICK

Manufacture. The Manufacture of Silica Brick, A. W. McMaster. Iron & Steel of Can., vol. 4, no. 10, Nov. 1921, pp. 267-268. Describes inauguration of the manufacture at Cape Breton from local materials. Operating costs; comparative analyses of quartzites; burning.

SLIDE RULES

Decimal Point Determination. Decimal Point Determination in Slide Rule Operation, James Theron Rood. Wisconsin Engr., vol. 26, no. 2, Nov. 1921, pp. 19-22, 3 figs. Gives examples to show how to secure greater accuracy.

SMOKE PREVENTION

Devices. The Black Smoke Problem, David Brownlie, Iron & Coal Trades Rev., vol. 103, no. 2807, Dec. 16, 1921, pp. 872-873. Causes and preventive devices; low-temperature carbonization.

STANDARDIZATION

Place of Laboratory in. The Place of the Laboratory in Standardization, W. P. Dobson. Eng. Inst. Can. Jl., vol. 5, no. 1, Jan. 1922, pp. 11-15, 6 figs. Types of engineering standards; measurement, constants, quality, performance; practice; work of laboratory in determining standards, methods employed by laboratories of Hydroelectric Power Commission of Ontario.

STEAM

Generation and Utilization. Fuel Economy by the Adoption of Scientific Management in Steam Generation and Utilization, David Brownlie. Eng. & Indus Management, vol. 6, nos. 23, 24 and 25, Dec. 8th, 15 and 22, 1921, pp. 653-656 7 figs.; 685-687, 4 figs.; and 719-722, 5 figs. Dec. 8: Feedwater heaters Dec. 15 and 22: Superheaters, and boiler and pipe covering.

STEAM-ELECTRIC PLANTS

Equipment. Rauber's Report to the Commission for Utilization of Fuels (Rapport de M. Rauber à la Commission d'utilisation des combustibles). Chaleur et Industrie, vol. 2, no. 19, Nov. 1921, pp. 727-735. Discusses steam-electric central stations, their equipment, type of boilers, superheat, economizers, feedwater heaters, etc.

STEAM ENGINES

UNAFLOW. [illegible] and Tests, L. A. Quayle. Power, vol. 55, [illegible] 17, 1922, [illegible] Universal unaflow engine exceeds grarantees on acceptance tests made after four years of continuous operation.

STEAM METERS

KENT MARINE. The Metering of Steam for Marine Purposes, also of Oil and Air, C. R. Sams. Trans. Inst. Mar. Engrs., vol. 33, Oct. 1921, pp. 375-388 and (discussion) 388-393, 10 figs. Describes the Kent steam meter which consists of an orifice carrier, cooling chambers and pressure piping, and a diagram recorder.

STEAM SHOVELS

CHANGING FROM HAND TO. Considerations in Changing a Quarry from Hand to Steam Shovel Method, Irving Warner. Eng. & Contracting, vol. 56, no. 25, Dec. 21, 1921, pp. 578-579. Discusses various local conditions and theur effect upon choice of proper equipment. (Abstract.) Paper read before Nat. Lime Assn.

STEAM TURBINES

DESIGN AND OPERATION. Major Turbine Troubles Diminished. Elec. World, vol. 79, no. 2, Jan. 14, 1922, pp. 77-80, 2 figs. Discusses blading lubrication and vibration; growth in turbine ratings; improvements in design.

STEEL

CHROME. *See Chrome Steel.*

CRUCIBLE. Comparison of American and English Methods of Producing High Grade Crucible Steel, T. Holland Nelson. Raw Material, vol. 4, no. 12, Dec. 1921, pp. 424-433, 24 figs. Discusses the merits and shortcomings of American and English practice. Presented before Am. Soc. for Steel Treating.

DEOXIDATION AND DESULPHURIZATION. Deoxidation and Desulphurization in the Heroult Furnace, F. T. Sisco. Chem. & Met. Eng., vol. 26, no. 1, Jan. 4, 1922, pp. 17-22. Describes three methods of working up a heat of steel. Discusses composition and characteristics of slags. Believes that good steel from poor scrap is a question of knowledge and skill.

ELECTRIC vs. CRUCIBLE. Crucible and Electric Tool Steel, W. J. and S. Stuart Green. Iron Age, vol. 109, no. 3, Jan. 19, 1922, pp. 201-205. Some aspects and choice in their manufacture. Points out that electric furnace bids fair to supplant crucible to greater degree than heretofore, though it is possible never completely.

HARDENING BY OVERSTRAIN. The Hardening of Steel by Overstrain, R. W. Chapman. Commonwealth Engr., vol. 9, no. 3, Oct. 1, 1921, pp. 74-75, 2 figs. Describes test showing that when steel is overstrained in tension so that its elastic limit in tension is raised, its elastic limit in compression is correspondingly lowered, and vice versa.

MANGANESE. *See Manganese Steel.*

MELTING. Leaves from a Steel Melter's Notebook, Henry D. Hibbard. Iron Age, vol. 108, nos. 17 and 21, Oct. 27 and Nov. 24, 1921, pp. 1065-1067 and 1337 and 1379-1380. Oct. 27: Experience in making hollow ingots for seamless pipe; effervescing and "killed" steel in an acid furnace. Nov. 24: Design of structure to resist shock or overstrain; car-coupler test illustrating necessity of proper distribution of metal.

MOLYBDENUM. *See Molybdenum Steel.*

ORDNANCE. Effect of Sulfur and Oxides in Ordnance Steel, William J. Priestley. Trans. Am. Inst. Min. & Metallurgical Engrs., no. 1109-S, 1921, 15 pp. 3 figs. Describes method by which desired physical properties of steel may be procured —by elimination of certain impurities that inherently exist in steel made by open-hearth process, and without use of expensive alloys. Abstract of paper in Min. & Metallurgy, no. 180, Dec. 1921, pp. 34-35. See also Iron Age, vol. [illegible] 29, 1921, pp. [illegible], 3 figs.

TUNGSTEN, METALLOGRAPHY. A Metallographic Study of Tungsten Steel (En metallografisk studie av volframstäl), Axel Hultgren. Jerkontorets Annaler, [illegible], pp. [illegible]-525, 22 figs. Discusses investigations as to transformations, critical points, free carbide, equilibrium diagrams and their significance, etc. Bibliography.

STEEL CASTINGS

[illegible] Steel Castings for Railway Rolling Stock, Ry. [illegible] 1922, [illegible] 3 figs. Describes production in [illegible] tender underframes, platform and end members for passenger rolling-stock and trailer trucks for locomotives by [illegible]

STEEL, HEAT TREATMENT OF

[illegible] for Heat Treatment of Steels [illegible]), Albert [illegible], vol. 18, no. 11, Nov. 1921, pp. 717-726 and (discussion) 727-728, 11 figs. Discusses the interdependence [illegible] state being a func- [illegible] Iron & Steel Inst., Paris.

ELEMENTS. Elements of the Heat-Treatment of Steel, H. J. French. Am. Mach., vol. 55, nos. 23, and 24, Dec. 8 and 15, 1921, pp. 907-908 and 960-964, 15 figs. Dec. 8: Operations in heat treatment; changes in structure while heating; changes produced by tempering and hardening: seasoning; effect of carburization. Dec. 15: Quenching operations; tempering.

TOOL STEEL. Volume Changes in Tool Steel on Heat Treating, L. A. Lanning. Forging & Heat Treating, vol. 7, no. 12, Dec. 1921, pp. 610-611, 2 figs. Effect of rates of heating, temperatures and quenching medium upon dimensions of cylindrical pieces of tool steels. Critical rate of heating important in hardening.

STEEL, HIGH-SPEED

HARDNESS. Hardness of High-Speed Steel. A. H. d'Arcambal. Chem & Met. Eng., vol. 25, no. 26, Dec 28, 1921, pp. 1168-1173, 8 figs. Hardness at various temperatures, hardness in the cold after various heat treatments, and cutting efficiency determined in an effort to predetermine usefulness of a modern machine tool.

Various Methods for Hardening High-Speed Steel, A. H. d'Arcambal. Chem. & Met. Eng., vol. 25, no. 25, Dec. 21, 1921, pp. 1150-1151. Discusses salt bath hardening, pack hardening, lead bath hardening, and semi-muffle furnace hardening.

METALLOGRAPHY. The Metallography of High Speed Steel, J. P. Gill and L. D. Bowman. Am. Soc. for Steel Treating Trans., vol. 2, no. 3, Dec. 1921, pp. 184-205, 56 figs. Discusses critical points and constitution of high-speed steels; secondary hardness; etching reagents, nomenclature; etc.

STEEL MANUFACTURE

BASSET PROCESS. The Basset Process (Le Procédé "Basset"). L'Outillage, vols. 235 and 236, nos. 47 and 48, Nov 24 and Dec 1, 1921, pp. 1259-1260 and 1287 1288, 1 fig. Gives copy of Basset's French patent published April 2, 1920, "Rotary furnace system for direct production of iron or steel or of pig iron," and discusses it and its prospects.

STEEL WORKS

COLD-DRAWING PLANT. LaSalle Co. Completes Cold Drawing Plant, Gilbert L. Lacher. Iron Age, vol. 109, no. 1, Jan. 5, 1922, pp. 27-31, 6 figs Designed for handling products in maximum lengths. Raw materials protected from elements.

FURNACES AND GAS PRODUCERS. Steel Works Furnaces and Gas Producers, J. S. Atkinson. Jl. West of Scotland Iron & Steel Inst., vol. 29, Part 1, Oct. Session 1921-1922, pp. 4-11 and (discussion) 11-14, 10 figs. on supp. plates. Discusses the principle of gas firing, mechanical producers, regeneration or recuperation, open-hearth furnaces, soaking pits, etc.

POWER GENERATION. Power Generation in Steel Plants, D. M. Petty. Engrs'. Club of Philadelphia Jl., vol 38-12, no. 204, Dec. 1921, pp. 392-397, 2 figs. Conclusions drawn from actual operating conditions of steel plant: Cost of power can be effectively reduced by increasing load factor; load factor in steel mills may be increased by careful arrangement of load and by supplying to central stations all surplus power not required during light load periods; etc.

STOKERS

MECHANICAL vs. HAND. Hand *versus* Mechanical Handling of Coal and Ashes in Municipal Power Plants—II, W. F. Schaphorst. Am. City, vol. 25, no. 5, Nov. 1921, pp. 415-521, 2 figs. Notes on underfeed and hand stokers, and points to be considered in selection of ash-handling system.

WOOD-REFUSE-BURNING. Burning Wood Refuse in Mechanical Stokers, R. L. Beers. Power House, vol. 15, no. 1, Jan. 5, 1922, pp. 30-33, 8 figs. Describes various types of boilers fitted with underfeed stokers for wood and other factory refuse.

STREAM POLLUTION

SEWAGE DISPOSAL AND. Stream Pollution and Sewage Disposal. Proc. Am. Soc. Civ. Engrs., vol. 47, no. 10, Dec. 1921, pp. 617-682. Symposium: Tanks and Fine Screens for Treating Sewage, George T. Hammlond. The Pollution of Tidal Harbors by Sewage with Especial Reference to New York Harbor, Kenneth Allen. Treatment of Storm-Water, John F. Skinner. Policies of the Engineering Division of the Pennsylvania Department of Health as to Public Sewerage, W. L. Stevenson. Stream Pollution and Its Control, Earle B. Phelps. Deposition of Sludges Resulting from Sewage Disposal Plants, T. Chalkley Hatton. The Dilution Factor, Langdon Pearse. Prevention of Misuse of Sewers, W. H. Dittoe. Discussion.

SUPERHEATERS

DESIGN. Steam Superheaters, Arthur D. Pratt. Steam, vol. 28, no. 5, Nov. 1921, pp. 125-127. Discusses design of superheaters and their operation.

SURVEYING

AERIAL PHOTOGRAPHY. Aerial Photography as Applied to Surveying, J. B. Mandeville. Engrs'. Soc. of Western Pa., Proc. vol. 37, no. 4, May 1921, pp. 189-206 and (Discussion) 207-220, 5 figs. Application of aerial photography in mapping; making oil and gas maps; mounting camera in airplane; etc.

T

TAYLOR SYSTEM

SHOP ORGANIZATION. An Intermediate Stage Toward the Taylor System in Shop Organization. Une étape vers le système Taylor [illegible], C. Bonnet. Arts et Métiers, vol. 74, no. 13, Oct. 1921, pp. 305-311, 5 figs. Discusses short-comings of French foreman and his gradual transformation.

TESTING MACHINES

ENDURANCE. Endurance Testing Machines, G. Shapera. Foundry Trade Jl., vol. 24, no. 276, Dec. 1, 1921, pp. [illegible] 2 figs. Describes the Krupp repeated impact machine and the Amsler wear-and-tear testing machine.

TEXTILE INDUSTRY

AUTOMOBILE MANUFACTURING METHODS APPLIED TO. Are Automobile Manufacturing Methods Applicable to the Textile Industry? Douglas T. Hamilton. Am. Mach., vol. 55, no. 25, Dec. 22, 1921, pp. 994-995. How the two industries developed. Contrasting production methods and machinery involved.

TIME STUDY

AUTOMATIC MACHINES. Modern Production Methods, W. R. Basset. Am. Mach., vol. 56, no. 3, Jan. 19, 1922, pp. 87-90, 3 figs. Time study on automatic machines. Notes on quality of labor employed, importance of standardization, rules of procedure and an example of rate setting.

MACHINE TOOLS. Modern Production Methods, W. R. Basset. Am. Mach., vol. 55, no. 26, Dec. 29, 1921, pp. 1037-1039, 1 fig. Special cases of time studies on engine lathes, surface and chucking grinding machines and semi-automatic turret lathes. Five steps in setting rates.

TRANSFORMERS

TRANSIENT VOLTAGE IN WINDINGS. Prevention of Transient Voltage in Windings, J. Murray Weed. Am. Inst. Elec. Engrs., Jl., vol. 41, no. 1, Jan. 1922, pp. 14-20, 11 figs. Relates to windings such as are used in transformers, reactors and the like, with particular reference to characteristics which determine internal distributions of suddenly impressed voltages or sudden voltage changes, and resulting internal oscillations. Explains phenomena of transient voltages as due to faulty arrangements of inherent capacity with inductance of winding.

PREMIUM WORK. Time Study for Profitable Piece Work or Premium, Samuel Theaker. Indus. Management, vol. 63, no 1, Jan. 1922, pp. 7-11, 5 figs. Discusses merits and methods of time premium work. Describes a decimal stop watch and gives examples of time study sheets.

TIRES, RUBBER

SPECIFICATIONS. Recommended Specifications for Pneumatic Tires, Solid Tires, and Inner Tubes. U. S. Bur. of Standards Circular, no. 115, Oct. 27, 1921, [illegible] pp. Revision of specifications prepared by Bureau and now used by War and Navy Departments, General Supply Committee, Post Office Department, Panama Canal and Treasury Department. Physical and chemical tests required are such that material purchased under these specifications will be satisfactory.

TRANSPORTATION

FACTORY. Analysis and Control of Factory Transportation, F. A. Pope. Factory, vol. 28, no. 1, Jan. 1922, pp. 38-42 and 72, 74, 76 and 78, 6 figs. Methods by which idle time is checked, performance records of tires and batteries best secured, daily service recorded, and final analysis of cost and performanec made by clerks without special training.

TURBO-GENERATORS

12,500-KW. 12,500 KW. Turbo-Generator for the Liverpool Corporation Electricity Works. Engineering, vol. 112, no. [illegible], Dec. [illegible], 1921, pp. [illegible] [illegible] plate. Steam turbine [illegible] constructed by Metropolitan-Vickers Elec. Co., Ltd., Manchester, England, is said to embody some very notable departures from normal type of impulse steam turbine.

V

VENTILATION

CALCULATING DUCT WEIGHTS. A Quick Method of Taking Off [illegible] Duct Work, J. J. Kojian. Sheet Metal Worker, vol 12, no. 25, Jan. 6, 1922, pp 834-835 and 838, 2 figs. Discusses method of estimating a ventilating job and shows how to develop formulas and tables.

W

WATER MAINS

TYPES. Some Observations Concerning Water-Supply Mains, J. W. Ledoux. N. E. Water Works Assn., Jl. vol. 35, no. 4, Dec. 1921, pp. 354-361, 1 fig. Consideration of various types of pipe obtainable, and discussion of concrete, wood and steel pipe as substitutes for cast iron pipe.

WATER PIPES

CORROSION. Prevention of Corrosion in Water Pipes—II. Sanitary and Heating Eng., vol. 96, no. 11, Nov. 18, 1921, pp. 315-316, 2 figs. Explains theory and operation of de-aerating de-activators as used in prevention of corrosion.

WAGES

PAYMENT BY RESULTS. Payment by Results, D. Lyon McLarty. Machinery (Lond.), vol. 19, no. 480, Dec. 8, 1921, pp. 289-291. Comparison between piecework and premium bonus systems and their application to working conditions.

JETS. Notes on Water Jets, J. A. Yates. Mech. World, vol. 70, nos. 1820 and 1825, Nov. 18 and Dec. 23, 1921, pp. 404-405 and 504-505, 3 figs. Nov. 18: Discusses relation between maximum horsepower obtainable from a jet issuing from a nozzle at end of a pipe line, length and diameter of pipe line, and supply head available. Dec. 23: Equations and calculations in connection with the efficiency of jets.

WATER POLLUTION

HARBORS. The Area of Water Surface as a Controlling Factor in the Condition of Polluted Harbor Waters, Richard H. Gould. Proc. Am. Soc. Civ. Engrs., vol. 47, no. 10, Dec. 1921, pp. 603-616, 5 figs. Discusses sources of oxygen required to meet demand of polluting matter in waters of New York harbor. It is shown that air is most imporant source of this oxygen which is obtained by direct absorption through water surface.

WATER POWER

DEVELOPMENT IN U. S. Federal Water Power Projects Up to December, 1921. Eng. News-Rec., vol. 88, no. 1, Jan. 5, 1922, pp. 24-26. Annual report of Federal Water Power Commission shows half-million horsepower under way. (Abstract.)

GREAT BRITAIN. Report of the Water Power Resources Committee. Engineer, vol 132, no. 3442, Dec. 16, 1921, p. 653. Resumé of final report of committee appointed by President of Board of Trade in 1918 to inquire into water-power resources of United Kingdom. Committee considers that in Great Britain some 210,000 kw. could be developed continuously from potential water powers at an economic rate, and for Ireland an available water power of 280,000 kw. continuous was estimated.

WORLD'S DEVELOPMENT. Study of World's Water Powers Completed. Power vol. 55, no. 1, Jan. 3, 1922, pp. 22-23. More than half of total developed water power is in North America. Africa has 190,000,000 horsepower potential water power and only 11,000 developed. Tables showing development in United States and Canada, and developed and potential water power of world in 1920 in horse-power. (Abstract.) World Atlas of Commercial Geology, issued by U. S. Geol. Survey.

WATER PURIFICATION

DEVELOPMENTS. Water Supply and Water Purification. Proc. Am. Soc. Civ. Engrs., vol. 47, no. 10, Dec. 1921, pp. 653-682. Symposium: History of Water Purification, George C. Whipple. Recent Developments in Water Filtration, Allen Hazen. Interference with Water Filtration Plant Operation by Wastes from By-Product Coke Ovens, C. A. Emerson. Recent Progress in the Reduction of the Typhoid Death Rate and Its Significance, C.-E. A. Winslow. Effect of Water Purification and Improvements in Water Supplies on the Typhoid Fever Death Rate in New York State, C. A. Holmquist. Purification of Soft Colored Waters, Robert S. Weston. Operation of Reservoirs for Water Supply, Samuel A. Greeley. Discussion.

HYDROGEN-ION CONCENTRATION. The Significance of "Hydrogen-Ion Concentration" in Water Purification, Harrison P. Eddy. N.E. Water Works Assn., Jl. vol. 35, no. 4, Dec. 1921, pp. 385-389 and (discussion) pp. 389-393. Writer enumerates advantages which may result from PH control of water purification plants, and claims there is little doubt that it will permit of a more intelligent study of water and reactions taking place during treatment.

WATER SUPPLY

DISSOLVED GASES. Dissolved Gases in Water Supplies. Chem. Age (Lond.), vol. 5, no. 129, Dec. 3, 1921, pp. 694-695. Discusses the various gases which are normally contained in natural water supplies, and describes tests employed for determining quantities in which they are present.

SANITARY PROTECTION. Sanitary Protection of Public Water Supplies, Allen Hazen. N.E. Water Works Assn. Jl. vol. 35, no. 4, Dec. 1921, pp. 297-304 and (discussion) pp. 304-308. Discusses relations between water supply and disease and what is [illegible] may be [illegible] be done to keep public water supplies from carrying disease.

WASTE PREVENTION. The Control of Water Waste by House-to-House Inspection, Gordon Z. Smith. N.E. Water Works Assn., Jl. vol. 35, no. 4, Dec. 1921, pp. 322-325 and (discussion) pp. 325-334. Describes inspection service of Bridgeport Hydraulic Co. serving water to city of Bridge port and neighboring towns.

WELDING

See Autogenous Welding; Electric Welding, Arc; Electric Welding, Resistance; Oxy-Acetylene Welding;

WIND TUNNELS

GÖTTINGEN, GERMANY. Göttingen Wind Tunnel for Testing Aircraft Models, Prandtl. Aerial Age Weekly, vol. 14, nos. 13 and 14, Dec. 5 and 12, 1921, pp. 298-299 and 302 and pp. 324-326, 9 figs. Depends on government and scientific societies for financial support. Describes equipment and operation. Designed for an air speed of 54 m/sec. with maximum of 60 m/sec. corresponding to an air efficiency of about 800 hp. From Zeit. für Flugtechnik und Motorluftschiffahrt

RESEARCH. The Scope of Wind Tunnel Research, E. N. Fales and F. W. Caldwell. Aerial Age Weekly, vol. 14, nos. 11 and 12, Nov. 21 and 28, 1921, pp. 248-250 and 270-272, 11 figs. Nov.21: Discusses extension and importance of aeronautical research and civil engineering problems in construction of wind tunnels. Nov. 28: Desirable characteristics; first cost; freedom from velocity fluctuations; suitability of existing tunnels for attainment of desirable characteristics, etc.

WIRE ROPE

STANDARD SPECIFICATION. Standard Specification for Wire Rope. Contract Rec., vol. 36, no. 1, Jan. 4, 1921, pp. 13-16. Canadian Engineering Standards Assn. drafts code covering wire rope mining, dredging and steam-shovel purposes.

WOOD

INFECTED. The Chemical Changes Involved during Infection and Decay of Wood and wood Pulp. Mark W. Bray and Joseph A. Staidl. Jl. Indus. & Eng. Chem., vol. 14, no. 1, Jan. 1922, pp. 35-40, 1 fig. Concludes that in all cases infected woods produce less pulp per unit weight of wood than sound woods. Paper read before Am. Chem. Soc.

WOODWORKING MACHINES

PLANES, NEW TYPES OF. Old and New Types of Planes, Oskar Spohr. Eng. Progress, vol. 2, no. 12, Dec. 1921, pp. 265-267, 12 figs. Compares old and new rabbet planes, describing the greatly improved features.

Engineering Index

This Index is prepared by the American Society of Mechanical Engineers.

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A

ABRASIVES

PROPERTIES AND USES. Grinding Wheels. Les Meules Artificielles, E. Assié. Arts et Métiers, vol. 74, no. 12, Sept. 1921, pp. 265-270, 7 figs. Discusses abrasives, carborundum, corundum, melting points, resistance to acid, use as refractories, etc.

ACCOUNTING

PIG-IRON PRODUCTION. Accounting for Pig Iron Production, Nathaniel B. Bergman. Jl. of Accountancy, vol. 33, no. 2, Feb. 1922, pp. [illegible]. Discusses blast-furnace operations and how to deal with them in accountancy.

AERONAUTICS

RESEARCH. Aeronautic Research, Joseph S. Ames. Jl. Franklin Inst., vol. 193, no. 1, Jan. 1922, pp. 15-28, 17 figs. Describes types of investigations in progress in aeronautics and methods pursued with especial reference to wind-tunnel experiments.

AIR CONDITIONING

AERO-HYDRO-FAN-SEPARATOR. Improvements in the Process for Drying and Cleaning Air Mechanically, William J. Baldwin. Am. Soc. Heat. & Vent. Engrs. Jl., vol. 28, no. 1, Jan. 1922, pp. 49-52, 1 figs. Describes recent improvements made in fan known as an aero-hydro-fan-separator, for washing, drying and conditioning air.

AIR DRYING. The Volume of Air Required in Air Drying, C. T. Mitchell. Chem. & Met. Engr., vol. 25, no. 24, Dec. 14, 1921, pp. 1088-1090, 3 figs. Factors affecting atmospheric evaporation, cooling of air during evaporation, distinction between wet bulb temperature and dew point, calculation of volume of air required; etc. Charts for 100, 85, and 70 per cent ultimate humidity.

INDUSTRIAL EFFICIENCY AND. The Influence of Atmospheric Conditions on Industrial Efficiency, H. M. Vernon. Eng. & Indus. Management, vol. 6, no. 26, Dec. 29, 1921, pp. 749-751, and vol. 7, no. 1, Jan. 5, 1922, pp. 12-13. Dec. 29: Notes on estimation of air movement; the best temperature; question of humidity; effect on accidents. Jan. 5: Influence of atmospheric conditions on health; bacterial infection necessity for adequate remedies. Lecture delivered before Royal Inst. Pub. Health.

AIRCRAFT

ARMAMENT LIMITATION CONFERENCE. Text of the Conference Discussion on Aircraft. Aerial Age Weekly, vol. 14, no. 21, Jan. 30, 1922, pp. 490-492. Text of official communiqué issued by Conference on Limitation of Armament dealing with discussion of aircraft in session of Committee on Limitation of Armament.
The Washington Conference and Aircraft. Aviation, vol. 12, no. 5, Jan. 30, 1922, pp. 128-132. Report of Sub-committee on limitation of aircraft as to numbers, character and use.

MAINTENANCE. Canadian Technical Memoranda. Aviation, vol. 12, no. 4, Jan. 23, 1922, pp. 105-106. Copy of technical memoranda issued by Canadian Air Board, on aircraft maintenance.

STRENGTH OF GREAT POWERS. Air Strength of the Great Powers. Aviation, vol. 12, no. 6, Feb. 6, 1922, pp. 164-166. Tables prepared by sub-committee on aircraft of Washington Conference giving authorized and actual air strength data for United States, France, Great Britain, Italy and Japan.

WIRE CABLE, ELASTICITY OF. A Study of the Elastic Properties of Small-Size Wire Cable, R. R. Moore. Mech. Eng., vol. 44, no. 2, Feb. 1922, pp. 105-106 and 111. Results of series of tests carried out at McCook Field, Dayton, Ohio, in whcih it is shown that modulus of elasticity of small-sized wire aircraft cable varies from 15,000,000 to 28,000,000, depending upon size and type of cable. It was also found that modulus of elasticity may be raised by loading cale below elastic limit and that resting the cable does not seem to have any definite effect on modulus.

AIRPLANE ENGINES

TESTS. British Tests for Aircraft Engines, Aerial Age Weekly, vol. 14, no. 19, Jan. 16, 1922, pp. 438-439. Gives schedule of standard tests to determine airworthiness of aircraft engines, issued by British Air Ministry.

AIRPLANE PROPELLERS

THRUST AND TORQUE CHARACTERISTICS. Tests on Air Propellers in Yaw, W. F. Durand and E. P. Lesley. Nat. Advisory Committee for Aeronautics Report, no. 113, 1921, 37 pp. 26 figs. Results on tests to determine thrust (pull) and torque characteristics of air propellers in movement relative to air in a line oblique to line of shaft, and specifically when such angle of obliquity is large, as in cast of helicopter flight with propeller serving for both sustentation and traction.

AIRPLANES

BRITISH. Aeronautics in 1921, Engineer, vol. 133, no. 2445, Jan. 6, 1922, pp. 18-21, 13 figs. partly on supp. plate. Review of British airplanes constructed during year.

COMMERCIAL. The "Bristol" 10-Seater Commercial Aeroplane. Flight, vol. 14, no. 3, Jan. 19, 1922, p. 39, 1 fig. 400-hp. Bristol "Jupiter" engine; speed at ground level, 112 m.p.h., speed at 5,000 ft., 110 m.p.h.
The D.H. Type 34 Commercial Biplane. Flight vol. 14, no. 1, Jan. 5, 1922, p. 4, 3 figs. 450-hp. Napier "Lion" engine; wing area, 590 ft.; weight, empty, with water, 3365 lb.; useful load, 10 passengers, 2000 lb. freight, 80 gal. petrol; cruising speed, 105 m.p.h.

PARIS SHOW. Seventh International Exposition of Aerial Locomotion (VII Exposition internationale de locomotion aérienne) André Lesage. Génie Civil, vol. 79, nos. 22, 23 and 24, Nov. 26, Dec. 3 and 10, 1921, pp. 464-468, 477-485 and 510-515, 41 figs. Discusses exhibit of French official services, materials, testing laboratories, French meteorological and aerial navigation service. describes different types of airplanes and airplane engines exhibited.

RIB FORMS, STRENGTH OF. The Strength of Airplane Rib Forms, D. T. Brown and R. J. Diefenbach. Mech. Eng., vol. 44, no. 2, Feb. 1922, pp. 110.111. Description of investigation to determine strength of plywood webs, with lightening holes arranged as in airplane ribs.

ALLOY STEELS

FAILURE, DUE TO INTERNAL STRESS. The Failure of Metals Through the Action of Internal Stress Irregularities with Special Reference to Tool Steels, J. Neill Greenwood. Faraday Soc. Trans., vol. 17, part 1, no. 49, Dec. 1921, pp. 123-138, 6 figs. Investigation of basic reasons for failures and measures for minimizing their occurrences. Bibliography.

ALLOYS

ALUMINUM. *See Aluminum Alloys.*

COPPER. *See Copper Alloys.*

IRON. *See Iron Alloys.*

ALUMINUM

BRITTLENESS OF. Brittleness Developed in Aluminum and Duralumin by Stress and Corrosion, Henry S. Rawdon, Alexander I. Krynitsky and Julius F. T. Berliner. Chem. & Met. Eng., vol. 26, no. 4, Jan. 25, 1922, pp. 154-158, 13 figs. Aluminum is deeply corroded where impurities lodge between primary grains, but, if recrystallized, is not embrittled; duralumin is subject to true intercrystalline embrittlement, but intensified by corrosion and stress.

ALUMINUM ALLOYS

DIE CASTING. Aluminum and Its Alloys—VI, F. A. Livermore. Metal Industry (Lond.), vol. 20, no. 2, Jan. 13, 1922, pp. 25-29, 7 figs. Deals with aluminum alloy die casting.

AMALGAMS

LOW-TEMPERATURE DISTILLATION. Low-Temperature Distillation of Amalgams of Bituminous Non-coking Coal and Asphaltic Oils, Joseph D. Davis, and C. E. Coleman. Am. Gas Jl., vol. 116, no. 4, Jan. 28, 1922, pp. 83-86, 1 fig. Describes experiments in distilling mixtures of coal and oil for production of coke. Main points investigated are quantity and quality of coke, quantity of oils boiling below 221 deg. cent. and oils boiling at 221 to 300 deg. cent., and quantity and quality of gases.

AMMONIA

SYNTHESIS OF. Synthesis of Ammonia (La recherche scientifique, ses applications à l'industrie et la synthèse industrielle de l'ammoniaque), Georges Claude. Revue Générale des Sciences, vol. 32, nos. 19 and 20, Oct. 15 and 30, 1921, pp. 534-543 and 570-581, 10 figs. Oct. 15: Difficulties of scientific research, its resources, etc.; manufacture of hydrogen, chlorine, helium, neon, etc. Oct. 30: Describes equipment and operations at Montereau Ammonia Extraction works working at a pressure of 1,000 atmos.

AMMONIA COMPRESSORS

STARTERLESS INDUCTION MOTORS FOR. Starterless Induction, Motors for Ammonia Compressors, J. Lebovici. Ice & Refrigeration, vol. 62, no. 1, Jan. 1922, pp. 24-25. Describes starterless motor, combining favorable characteristics of squirrel-cage and slip-ring types, making an ideal drive for ammonia compressors using up to 150-hp. Paper read before Nat. Assn. Practical Refrig. Engrs.

APPRENTICES, TRAINING OF

PLANT VS. CONTINUATION SCHOOLS. The Training of Workers in Manufacture, J. V. L. Morris. Am. Mach., vol. 56, no. 7, Feb. 16, 1922, pp. 249-251. General conditions of apprenticeship; problems arising from school; plant school vs. part-time and continuation schools.

ARCHES

CIRCULAR. The Circular Arch under Normal Loads. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 1, Jan. 1922, pp. 91-98, 1 fig. Discussion by B. F. Jakobsen of paper by William Cain published in same journal (Dec. 1921).

AUTOMOBILE ENGINES

AIR-COOLED. Air-Cooling Systems: Past, Present and Future. Autocar, vol. 28, no. 1369, Jan. 14, 1922, pp. 47-50, 7 figs. Gives concise summary of the various points for and against use of air-cooled engines for small cars; directions in which developments must tend.

CYLINDERS. Cylinders for the Mack Motor, Fred. H. Colvin. Am. Mach., vol. 56, no. 5, Feb. 2, 1922, pp. 173-174, 7 figs. Fixtures, trams and gages for locating cylinder from bore. Inspection methods which secure results. Volume of compression chamber tested by liquid gage.

Operations on the Cylinders of the Wills Sainte Claire, Fred H. Colvin. Am. Mach., vol. 56, no. 5, Feb. 9, 1922, pp. 216-218, 12 figs. Closed end cylinders require special tools for machining combustion chambers. Special boring machine with inclined spindles. Heat-treatment removes strains.

NEW YORK SHOW. Powerplant Trends as Seen at the Show, Herbert Chase. Automotive Industries, vol. 46, no. 2, Jan. 12, 1922, pp. 62-65, 3 figs. Discusses cooling systems, aids to starting, lubrication and piston design, valves, gearing and crankshafts, etc.

PEUGOT-TARTRAIS DIRECT-INJECTION. Peugeot To Produce Automotive Injection Engine, W. F. Bradley. Automotive Industries, vol. 46, no. 6, Feb. 9, 1922, pp. 269-271, 11 figs. Said to be capable of using any liquid fuel; two-stroke cycle; develops 50-hp. at 1250 r.p.m.; weight, 550 lbs.; uses 0.397 lb. fuel per hp. hr. at full load and 0.484 lb. at quarter load. See also Commercial Ve-[illegible] 1, Feb. 1, 1922, p. 31, 3 figs.

TWO-STROKE CYCLE. The Two-Stroke Motor Car Engine, F. W. Lanchester and R. H. Pearsall. Engineering, vol. 133, nos. 2925 and 2926, Jan. 20 and 27, 1922, pp. 90-92 and 122-124, 16 figs. Investigation of principal factors controlling [illegible] Paper read before Instn. Automobile Engrs.

AUTOMOBILES

BRAKES. Automobile Brakes, Sydney V. James. Armour Engr., vol. 13, no. 1, Nov. 1921, pp. 1-21, 9 figs. Discusses mechanics of motion as applied to brakes and braking, actual brake mechanisms and typical braking systems, [illegible] internal expanding types, and brake [illegible]

FRONT-AXLE STUBS. Machining Automobile Front Axle Stubs, F. Hickling. Machy. (Lond.), vol. 19, no. 487, Jan. 26, 1922, pp. 497-499, 7 figs. Discusses layout for a particular type of stub, which has been in use for over two years, on a [illegible]

GEAR BOXES. Notes on Motor Car Gearboxes, H. F. L. Orcutt. Automobile Engr., vol. 12, no. 159, Jan. 1922, pp. 22-30, 7 figs. Discusses principal defects relating to design, workmanship and material. Describes gear-tooth grinding process. [illegible] Automobile Engrs.

MANUFACTURE. Cars in the Making. Autocar, vol. 47, nos. 1365, 1366 and 1367, Dec. 17, 24 and 31, 1921, pp. 1254-1255, 1289-1291 and 1341-1343, 18 figs. Dec. 17: Practical working out of designs by experimental work. Dec. 24: Describes methods by which raw materials are worked up into forms suitable for economic processes of machine-shop production. Dec. 31: Deals with preparation of tools and jigs, and explains methods of using lathe to secure interchangeability of parts.

NEW YORK SHOW. Trends in Chassis Design at the New York Show, P. M. Heldt. Automotive Industries, vol. 46, no. 2, Jan. 12, 1922, pp. 58-62, 8 figs. Discusses various improvements, including changes in clutch, transmission locks, gear shifting, and steering wheel.

REPAIR-SHOP PRACTICE. Automobile Repair-Shop Practice. Machinery (Lond.), vol. 19, no. 485, Jan. 12, 1922, pp. 445-447, 4 figs. Describes methods and equipment commonly employed in automobile repair-shop practice.

SERVICE EQUIPMENT. Automotive Service Methods and Equipment, Howard Campbell. Am. Mach., vol. 56, no. 4, Jan. 26, 1922, pp. 125-127, 11 figs. Tools used for servicing Hudson and Essex Cars. Fixtures for testing and straightening. Attachments for lapping pistons and cylinders.

AVIATION

COMMERCIAL. Air Lines and Some of Their Problems, R. B. C. Noordnyn. Mech. Eng., vol. 44, no. 2, Feb. 1922, pp. 107-109 and 111. Detailed account of progress of commercial aviation in Europe, tracing development from time of post-war experimental work with military machines and fields, to present successful operation with proper machines and schedules and with Government subsidies.

FRENCH CIVIL TRANSPORT. French Progress in Civil Air Transport, M. de Lavergne. Aviation, vol. 12, no. 6, Feb. 6, 1922, pp. 170-171. In three years French merchant air fleet expanded from 46 airplanes to 258, all of which are used on regular transport services.

B

BEARINGS, BALL

DESIGN AND PERFORMANCE. Ball and Roller Bearings: Their Design and Performance. A. W. Macaulay. Engineering, vol. 113, no. 2925, Jan. 20, 1922, p. 87, 6 figs. Points out that principal conditions which bearing must fulfill are (1) capacity for taking combined radial and thrust load; (2) self-contained unit having no loose parts, and without necessity of any adjustment; (3) high fatigue limit; (4) lowest possible friction; (5) absence of vibration. (Abstract.) Paper read before Instn. Engrs. & Shipbuilders in Scotland.

BLAST FURNACES

HOT-BLAST STOVE RATING. Hot Blast Stove Rating, F. H. Willcox. Blast Furnace & Steel Plant, vol. 10, no. 1, Jan. 1922, pp. 29-32. Actual test data showing effectiveness of hot blast stove equipment as applied to a 600-ton blast furnace.

REBUILT. Rebuilds Stack on Historic Site Richard Peters, Jr. Iron Trade Rev., vol 70, no. 5, Feb. 2, 1922, pp. 325-328, 5 figs. Furnace succeeding famous Warwick unit has been replaced, work involving construction of new stack, top and downcomers. New Blast furnace has skip bridge with independent shear leg support.

BLOWERS

ROOTS. Hints on Repairing Roots Blowers, F. R. Parsons. Mech. World, vol. 71, no. 1830, Jan. 27, 1922, pp. 64-65, 3 figs. Maintenance and efficient upkeep of Roots pressure blowers; sources of trouble and suggested remedies; lubrication and belt troubles.

TURBO. Turbo-Boosters and Exhausters for Town Gas. Engineering, vol. 133, no. 2926, Jan. 27, 1922, pp. 105-106, 8 figs., partly on p. 108. Deals with some of later developments by The Bryan Donkin Co., Ltd., Chesterfield, England, partictlarly the Rateau turbo-blowers and fans.

BOILER EXPLOSIONS

CAUSES. A New Boiler Explosion, G. W. Atkinson. Power, vol. 55, no. 6, Feb. 7, 1922, pp. 206-207, 3 figs. Leakage near flange of bumped head led to investigation which disclosed dangerous crack. Breathing of head probable cause.

BOILER OPERATION

AUTOMATIC DRAFT REGULATION. Automatic Draft Regulation in Steam Boiler Rooms (La régulation automatique du tirage dans les chaufferies de générateurs à vapeur), Jean Delestrade. Technique Moderne, vol. 13, no. 12, Dec. 1921, pp. 510-518, 14 figs. Describes complete operation of a battery of four Babcock boilers, of which one is auxiliary, producing 10,000 kg. steam per hr. at 14.5 kg. pressure.

CO_2 VALUES, INTERPRETING. Effect of Coal on Excess Air in Boiler Operation, Hugh R. Carr. Power Plant Eng., vol. 26, no. 2, Jan. 15, 1922, pp. 112-114, 2 figs. Considerations to be taken into account in interpreting CO_2 values with different kinds of coal.

EFFICIENT. The Necessity for and Savings Possible with Better Boiler-Room Operation. C. W. DeForest. Power, vol. 55, no. 4, Jan. 24, 1922, pp. 139-141, 3 figs. Deals with cost of fuel, organization, boiler-room instruments and records. (Abstract.) Paper read before Stoker Mfrs. Assn.

BOILER PLANTS

Ford Motor Co. Power House. A large American Power Plant. Eng. Production, vol. 4, nos. 68 and 69, Jan. 19 and 26, 1922, pp. [illegible] figs. Details of boiler equipment of Ford Motor Co. (Abstract.) Paper presented to Engrs. Soc. West Pa., by George T. Ladd, with [illegible] by H. [illegible] Savage and J. R. Le Valley.

Valuation. Valuation of the Boiler Plant, Allen F. Brewer. Combustion, vol. 6, no. 2, Feb. 1922, pp. [illegible]. Notes [illegible] estimation salvage and service values.

BOILERS

Capacities. Boiler Capacities Obtainable per Cubic Foot of Furnace Volume, T. B. Stillman. Power, vol. 55, no. 5, Jan. 31, 1922, pp. 171-173, 3 figs. Detailed test results on boilers operating at as high as 658.9 per cent rating. In one case 2285 lb. of oil was burned per hr. per burner. Paper presented before Assn. Edison Illuminating Companies.

Locomotive. *See Locomotive Boilers.*

Marine. *See Marine Boilers.*

BOILERS, WATER-TUBE

Marine. A New Water-Tube Boiler For Merchant Ships. Mar. Engr. & Naval Architect, vol. 45, no. 532, Jan. 1922, pp. 10-11 and 40, 2 figs. Describes the Hawthorn-Armstrong patent boiler in which an effort had been made to combine in one unit a steam generator suitable for use in merchant ships and to provide a high degree of superheat.

BORING MACHINES

Machining Locomotive Brasses. Machining Locomotive Brasses on Boring Mill, J. H. Moore. Can. Machy., vol. 27, no. 2, Jan. 12, 1922, pp. 17-19, 9 figs. Importance of proper fixtures if maximum production is to be attained. Describes machining of a 9-in. globe valve.

BRAKES

Freight-Train Vacuum. Railway Brakes for Heavy Traffic. Engineering vol. 113, no. 2924, Jan. 13, 1922, p. 43. Abstracts of two papers read before Instn. Civ. Engrs., entitled, Control of Trains Considered in Relation to Increase of Weight and Speed. Combined with reduced Headway, by Alan Wood Rendell; and Trials in Connection with the Application of the Vacuum Brake for Long Freight Trains, Henry Fowler and Herbert N. Gresley.

BRASS

British Industry. Modern Developments in the British Brass Industry, Ernest T. Smith. Can. Chem. & Metallurgy, vols. 5 and 6, nos. 12 and 1, Dec. 1921 and Jan. 1922, pp. 345-348 and 8-12. Discusses extent to which existing scientific and technical knowledge has been utilized in British brass industry as a whole and describes development resulting from its utilization. Melting and foundry practice; electric furnaces; extrusion of brass; hot pressing and forging; rolling-mill practice; annealing; composition of brasses and special alloys; research and its organization. Paper read before Am. Electrochem. Soc.

Rod. Modern Methods of Making Brass Rod. Brass World, vol. 18, no. 1, Jan. 1922, pp. 3—4, 9 figs. partly on pp. 5—7. Describes development of extrusion process and present-day extrusion machines.

Season Cracking. The Prevention of Season Cracking in Brass by the Removal of Internal Stress, H. Moore and S. Beckinsale. Faraday Soc. Trans., vol. 17, part 1, no. 49, Dec. 1921. pp. 162-192, 22 figs. Reduction of stress by low-temperature annealing was studied in 70:30 brass cold rolled to 120, 160, and 200 Brinell hardness, in elastically bent test-strips of each hardness, initally stressed to 11, 17, and 22 tons per sq. in. maximum tension at surface. Results are presented in tables and summarized.

BRIDGE PIERS

Bascule-Bridge. Burlington Bridge, Near Hamilton, Involved Difficult Foundation Problems, F. W. Paulin. Contract Rec., vol. 36, no. 6, Feb. 8, 1922, pp. 125-126, 3 figs. Strauss bascule span replaces swing structure. Presence of sand for depth of 100 ft. made extensive piling necessary. Sheet steel cofferdam enclosed pier sites. Continuous pumping to keep water down.

BRIDGES, HIGHWAY

Reinforced-Concrete. Some Features of the Chemung River Concrete Bridge. Eng. News-Rec., vol. 88, no. 5, Feb. 2, 1922, pp. 188-192, 9 figs. Construction details of seven-arch bridge at Corning, N.Y. All parts of bridge are reinforced concrete poured in place even to foundation piles and lamp posts on parapets. Notes on reinforcement interlocking, waterproofing details and flood protection of plant.

Steel. New Road Bridge Opened Over Sixteen Mile Creek, T. D. Mylrea. Can. Engr., vol. 42, no. 6, Feb. 7, 1922, pp. 203-205, 7 figs. Said to be longest bridge yet constructed on provincial highways. 85 ft. steel truss span with 16-ft. roadway. Superstructure consists of concrete floor carried upon 8 spans of lattice trusses.

BRIDGES, RAILWAY

Impact Tests. English Impact Measurements Analysed, F. E. Turneaure. Eng. News-Rec., vol. 88, no. 3, Jan. 19, 1922, pp. 104-106. Significance of results and comparison with Am. Ry. Eng. Assn. tests. Deficiency of observed live-load stresses. Influence of secondary stresses. Impact on short spans.

Strength. The Strength of Old Railway Bridges, Conrad Gribble. Ry. Gaz., vol. 35, no. 27, Dec. 30, 1921, pp. 995-996 and 999. Unknown factors which affect stresses. Necessity for scientific experimental work.

BRONZE

Manganese. Manganese Copper, Jesse L. Jones. Metal Industry (N.Y.), vol. 20, no. 1, Jan. 1922, p. 7. Discusses its use in manufacture of manganese bronze, and methods of obtaining best results.

BUILDING LAWS

Ideal Codes. Building Codes, R. Fleming. Eng. & Contracting, vol. 57, no. 4, Jan. 25, 1922, p. 88. Discusses essentials of an ideal building code. (Abstract.) Paper read before Engrs. Club of Trenton, N.J.

Standardization of Codes. Standardization of Building Codes. Contract Rec., vol. 36, no. 6, Feb. 8, 1922, pp. 135-137. Suggested outline for civic building by-law drawn up by Assoc. Gen. Contractors of America, that aims to simplify and unify requirements.

C

CABLES, ELECTRIC

Lead Sheathing, Failure of. Failure of the Lead Sheathing of Electric Cables, L. Archbutt. Faraday Soc. Trans., vol. 17, part 1, no. 49, Dec. 1921, pp. 22-35, 22 figs. Results of inspection of cables used in connection with automatic signalling and other cables. In writer's opinion, peculiar types of structure observed in several of the defective sheaths is developed in process of extrusion and cable makers shou d investigate to discover conditions which give rise to it.

CABLEWAYS

Aerial. Automatic Aerial Tramway. Rock Products, vol. 25, no. 3, Feb. 11, 1922, pp. 26-27, 2 figs. Tramway at Clinchfield Products Corp.operating a barytes mine at Evington, Va., is reversible; hauls both coal and ore.

Track Cables. Tensions in Track Cables and Logging Skylines, Samuel Herbert Anderson. University of Washington Eng. Experiment Station Bul., no. 13, June 1921, 27 pp., 5 figs. Deals with problem of catenary loaded at one point. Equations are derived and properties of such catenary discussed. It is shown how tensions may be computed and what the condition is for maximum tension.

CAR LIGHTING

Electric. Electric Illumination for Trains, Richard Hanchen. Eng. Progress, vol. 3, no. 1, Jan. 1922, pp. 1-3, 6 figs. Notes on continuous electric train lighting for individual cars; drive of dynamo; voltage control; charging and life of battery; etc.

Principles of Car Lighting by Electricity—XVII, Charles W. T. Stuart. Ry. Elec. Engr., vol. 13, no. 1, Jan. 1922, pp. 9-17, 15 figs. Describes the Gould simplex system of car lighting, consisting of a generator driven by a belt from car axle, a generator regulator panel, a lamp regulator panel mounted in a cabinet inside or under car body, and a storage battery suspended in a box under car body.

CAR WHEELS

Machining. Correct Machining and Mounting of Wheels and Axles and the Necessity for Carefully Measuring Axles Removed from Cars so that Proper Credits can be Allowed, Chas. Petran. Official Proc. of Car Foremen's Assn. of Chicago, vol. 17, no. 3, Dec. 1921, pp. 16-29 and (discussion) 30-57, 3 figs. Discusses boring of cast iron wheels; fitting wheels to axles; wheel mounting pressure nad its automatic registration; instructions to guard against wrong inspection of axles; rolled-steel wheels; etc.

Manufacture. Wheels for Railway Rolling-Stock. Ry. Gaz., vol. 35, no. 27, Dec. 30, 1921, pp. 1000-1002, 6 figs. Describes new process of manufacturing wheel centers of the solid disk type.

Steel-Tired. Cast-steel and Steel-tyred Wheels, H. W. Mellor. Machinery (Lond.), vol. 19, no. 486, Jan. 19, 1922, p. 479, 4 figs. Suitable thickness for steel tires, and rims for steel wheels.

Sandberg Sorbitic Steel for Tyres. Ry. Gaz., vol. 35, no. 27, Dec. 30, 1921, pp. 991-992 and 999, 6 figs., partly on p. 993. Improvements due to Sandberg process which add considerably to capacity of rolling stock and reduce occupancy of repair shops. See also Ry. Engr., vol. 43, no. 504, Jan. 1922, pp. 16-17 and 35, 6 figs.

CARS

Hose Connectors. Recent Changes in American Hose Connectors. Ry. Age., vol. 72, no. 6, Feb. 11, 1922, pp. 375-377, 4 figs. Describes connector manufactured by Am. Automatic Connector Co., Cleveland, Ohio, and Tests made.

Reclaiming Metal Roof Sheets. Reclaiming Sheets of Outside Metal Car Roofs. Ry. Age, vol. 72, no. 4, Jan. 28, 1922, pp. 275-276, 4 figs. Savings in car repair costs are result of moderate expenditures for facilities.

CARS, PASSENGER

Articulated Dining. Articulated Units Feature Recent English Car Design. Ry. Rev., vol. 70, no. 4, Jan. 28, 1922, pp. 109-113, 6 figs. Describes new dining-car train, showing advantages of articulated design and use of electricity for cooking.

Sleeping and Compartment. New Sleeping and Compartment Cars for the C.P.R. Ry. Rev., vol. 70, no. 3, Jan. 21, 1922, pp. 77-81, 8 figs. Designed for service on transcontinental trains with special regard for comfort of women travelers.

CASE-HARDENING

Charcoal Carbonization. Carbonization With Wood Charcoal, H. Schagrin. Am. Soc. for Steel Treating Trans., vol. 2, no. 4, Jan. 1922, pp. 331-335 and (discussion) 335-338, 12 figs. Discusses tests made with drop forgings of acid bessemer steel which showed that charcoal was cheap and satisfactory casing material.

CAST IRON

Hardness Tests. Mechanical and Elastic Properties of Cast Iron and the Use of the Ball Hardness Test (Caractéristiques méchaniques et élastiques des fontes et utilisation de l'essai à la bille), Albert Portevin. Revue de Métallurgie, vol. 18, no. 12, Dec. 1921, pp. 761-779, 19 figs. Discusses tests required by French artillery for steeled iron shells, including elongation, compression and hardness.

Malleable. American Malleable Cast Iron, H. A. Schwartz. Iron Trade Rev., vol. 70, nos. 5 and 6, Feb. 2 and 9, 1922, pp. 335-341 and 410-411, 14 figs. Mechanical effects of plastic deformation.

Malleableizing of White Cast Iron, Arthur Phillips and E. S. Davenport. Am. Inst. Min. & Metallurgical Engrs. Trans., no. 1117-S, 1922, 23 pp., 49 figs., and (in abstract) Min. & Metallurgy, no. 181, Jan. 1922, pp. 31-32. Presents data and observations resulting from series of experiments dealing with heat treatment and microstructure of commercial white cast iron and its derivative, malleable iron.

Synthetic. Manufacture of Synthetic Cast Iron in the Electric Furnace, W. L. Morson. Chem. & Met. Eng., vol. 26, no. 7, Feb. 15, 1922, pp. 312-316. Production on Pacific coast: detrimental effects of excessive dry slags; comparative operating costs.

CASTINGS

Automobile. British Motor Castings Methods—III, Ben Shaw and James Edgar. Foundry, vol. 50, no. 3, Feb. 1, 1922, pp. 103-107, 23 figs. Making of patterns and coreboxes for a typical crankcase casting; detail and reasons for methods recommenced.

CENTRAL STATIONS

Operating Expenses. Operating Expenses of Six Plants. Elec. World, vol. 79, no. 3, Jan. 21, 1922, pp. 131-132. Study of Massachusetts stations emphasizes advantages of electrical equipment from upkeep standpoint. Data indicate changes which are taking place as result of transition to new industrial basis.

Superpower, France. The Superpower Station at Gennevilliers (La supercentrale de Gennevilliers), L. D. Fourcault. Technique Moderne, vol. 13, no. 12, Dec. 1921, pp. 525-527, 9 figs. partly on supp plate. Describes civil engineering work, including foundations, especially for machines.

CHROME STEEL

Properties. Chromium Steels and Irons. Leslie Aitchison. Automobile Engr., vol. 11, no. 158, Dec. 1921, pp. 453-458, 5 figs. Discusses the three main advantages of alloy steels as against carbon steels, viz., high tensile strength, high toughness, ease in hardening and homogeneity in resulting product. Mechanical properties of chromium steels and irons. Paper read before Instn. Automobile Engrs.

CHROME-NICKEL STEEL

Krupp Rustproof. Krupp Rustproof Steel, Fritz Huth. Mech. Eng., vol. 44, no. 2, Feb. 1922, pp. 120-121. Developed as result of investigations carried out at establishment during years 1909 to 1914 on corrosion of steel and belonging to class of chrome-nickel steels. Translated from Metall-Technik, vol. 47, Nov. 1, 1921, p. 123.

CLUTCHES

Pomini Friction. The Pomini Friction Clutch. Engineering, vol. 113, no. 2925, Jan. 20, 1922, pp. 70-71, 32 figs. Partly on supp. plate. Describes clutch constructed by Societa Anonima Luigi Pomini Castellanza, Italy, known as "Superpotente," and intended to transmit 3000 hp. at 330 r.p.m. It is suitable for coupling Diesel engines to propeller shafts in submersible boats. Several were delivered to Italian Navy for war service.

COAL

Dry Concentration. Dry Concentration of Coal, Ray W. Arms. Coal Industry, vol. 5, no. 1, Jan. 1922, pp. 29-32, 3 figs. Discusses principles tried in dry concentration, such as dry panning, dry blanket, friction, shape, friability, etc.

Flotation. Notes on Coal Flotation, P. E. Peterson. Can. Inst. Min. & Met. Bul. no. 117, Jan. 1922, 62-66, 6 figs. Results of experimental work to test suitability of flotation process for cleaning of Vancouver Island coals.

Low-Temperature Carbonization. Carbonizing Noncoking Soft Coal, Joseph D. Davis and C. E. Coleman. Gas Age-Rec., vol. 49, no. 4, Jan. 28, 1922, pp. 107-109, 1 fig. Report on research in low temperature coking of a mixture of 70 parts noncoking bituminous coal with 30 parts of petroleum made by Bur. of Mines at Pittsburgh station.

Low-Temperature Distillation. Products of Low Temperature Distillation of Coal, Walter Runge. Chem. Age (N.Y.), vol. 30, no. 1, Jan. 1922, pp. 9-10. Describes Smith process, and compares by-products of high and low temperature distillation, especially tar.

COKE OVENS

By-Product. New By-Product Coke Oven Plants, J. M. Hastings, Jr., Blast Furnace & Steel Plant, vol. 10, no. 1, Jan. 1922, pp. 12-17, 9 figs. Describes the Rosedale and Franklin plants constructed by Semet Solvay Co., for Cambria Steel Co. at Johnstown, Pa. Some difficulties which were successfully overcome.

COLLOIDS

Physics and Chemistry of. The Physics and Chemistry of Colloids and Their Bearing on Industrial Questions. Faraday Soc. Trans. vol. 16, part 3, no. 48, July 1921, pp. 1-190. General discussion held by Faraday Soc. and Phy- [illegible] entitled "A Short Survey [illegible] Svedberg. Deals with general [illegible], properties and structures [illegible] nature of [illegible] ueous colloidal systems; action of light and [illegible] of disperse systems; electrical theory of ab- [illegible] deposition of metals; internal pressure of liquids

COLUMNS

Buckling. Buckling of Elastic Structures. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 1, Jan. 1922, pp. 103-110, 1 fig. Discussion by George Paaswell of paper by H. M. Westergaard published in same journal (Nov. 1921.).

COMPRESSED AIR

High-Pressure Handling. Methods of Handling Very High Pressures, P. W. Bridgman. Compressed Air Mag., vol. 27, no. 1, Jan. 1922, pp. 17-19, 5 figs. Explains methods of packing pistons and joints in order to obtain pressures up to 500,000 lb. per sq. in.

CONCRETE

Moisture Content, Effect of. A Study of the Effect of Moisture Content upon the Expansion and Contraction of Plain and Reinforced Concrete, Torata Matsumoto. University of Ill. Bul., vol. 19, no. 14, Dec. 5, 1921, 29 pp., 12 figs. Describes tests made to investigate amount of shrinkage which may be expected in a mortar or concrete, relation between change of moisture content and change of length of these materials, difference in shrinkage of plain and reinforced concrete, and internal stresses set up in latter.

Proportioning. Two Recent Methods for Proportioning Concrete, H. H. Scofield. Cement & Eng. News, vol. 34, no. 2, Feb. 1922, pp. 28-29, 9 figs. Notes on fineness modulus and surface area methods of designing concrete mixtures.

CONCRETING

Cold-Weather. Practical Side of Cold Weather Concreting. Eng. & Contracting, vol. 57, no. 4, Jan. 25, 1922, pp. 83-85, 3 figs. Experiences of the Turner Constr. Co., New York, in erection of concrete structures in winter months. Series of experiments made in laboratory of University of Illinois and published in Proc. Am. Concrete Inst.

CONDENSERS, STEAM

Surface. Measurement of Surface-Condenser Leakage by Electrolytic-Conductivity Method. Earl A. Keeler. Power, vol. 55, no. 4, Jan. 21, 1922, pp. 126-128, 6 figs. Discusses difficulties in applying electrical methods to measuring condenser leakage, and how some of these difficulties have been overcome. How measurements are made. Factors affecting accuracy of measurements.

CONNECTING RODS

Side Thrust to Obliquity. Side Thrust due to Obliquity of the Connecting Rod in a High Speed Reciprocating Engine, Tetsuji Sugihara. Technology Reports of Tôhoku Imperial University. vol. 2, no. 3, 1921, pp. 17-26, 7 figs. Writer seeks to obtain expression for side thrust due to obliquity of connecting rod, and expresses it graphically when these effects are taken into account.

CONVERTERS

Bessemer Side-Blown. New Side-Blown Bessemer Converter. T. Levoz. Mech. Engr., vol. 44, no. 2, Feb. 1922, p. 122, 1 fig. Historical account of development, with criticism of various types. Describes type developed by author and points out its advantages. Translated from Fonderie Moderne, no. 10, Oct. 1922, pp. 284-290, 3 figs.

CONVEYORS

Overhead System. Double-Rail Overhead Conveying System, G. L. Lacher. Iron Age, vol. 109, no. 6, Feb. 9, 1922, pp. 409-410, 5 figs. Safeguards against track-jumping. Trolleys have two, four or eight wheels, and can carry load of 3000 lb.

Steel Belt. Swedish Steel Belt Conveyors, Harry Carlson. Iron Age, vol. 109, no. 5, Feb. 2, 1922, pp. 321-323, 7 figs. Especially adapted to hot and sticky materials, which cannot be carried on rubber or fabric belts. Lower power cost.

Types. Conveying and Elevating Machinery, Gardner Mitchell. Eng. & Indus. Management, vol. 7, no. 4, Jan. 26, 1922, pp. 109-114, 6 figs. Deals with spiral or worm, screw, paddle, belt, gravity-bucket, tray, slat, push-plate or scraper, and drag-link conveyors: and chain, belt and bucket elevators. Paper read before (British) Instn. Mech. Engrs.

COPPER ALLOYS

Phosphor-Copper. Phosphor Copper. Jesse L. Jones. Metal Industry (N.Y.), vol. 20, no. 1, Jan. 1922, pp. 6-7. Discusses its increased use as a deoxidizer, and methods of obtaining best results.

CORROSION

Causes and Prevention. What It Pays to Know About Corrosion, G. A. Van Brunt. Factory, vol. 27, nos. 5 and 6, Nov. and Dec. 1921, pp. 621-623 and 763-766, 1 fig. and vol. 28, nos. 1 and 2, Jan. and Feb. 1922, pp. 49-52, 4 figs., and pp. 172-174. Nov. Causes and best methods of preventing corrosion. Dec: How coatings of various metals, variously applied, protect iron and steel. Jan: Where to use coatings of paint and japan. Feb: Oxides and phosphates: Where to use them as protective coatings.

Condenser Tubes. Results Achieved by the Corrosion Committee British Institute of Metals, Ernest E. Thum. Chem. & Met. Eng., vol. 26, no. 7, Feb., 15, 1922, pp. 301-306, 9 figs. Discusses failure of brass condenser tubes in marine service, caused by lodgment of solids which trap corrosive substances formed during process of slow general thinning.

Zinc and Tin. Corrosion Patterns on Cold-Worked Tin and Zinc, Henry S. Rawdon, Alexander I. Krynitsky and Julius F. T. Berliner. Chem. & Met. Eng., vol. 26, no. 5, Feb. 1, 1922, pp. 212-213, 3 figs. Properties of tin and zinc after deep corrosion.

COST ACCOUNTING

Chemical. Some Phases of Chemical Cost Accounting, C. B. J. Rosen. Chem. Age, N.Y., vol. 29, no. 12, Dec. 1921, pp. [illegible]. Discusses the question of process costs and their management.

Machine-Rate. Machine Rate Costing in Engineering Manufacturing Works, G. W. Beale. Jl. Indus. Administration, vol. 1, no. 8, Dec. 1921, pp. 246-253. Series of arguments leading to the conclusion that it is not commercially profitable to include machine rate costs in the regular recorded system of cost accounts of an engineering manufacturing works, but that it finds its true place in estimated costs.

COST SYSTEMS

Relation to Production. The Costing System and Its Relation to Production, G. H. Hales. Eng. & Indus. Management, vol. 17, nos. 1, 2, 3, and 4, Jan. 5, 12, 19 and 26, 1922, pp. 17-19, 31-34, 63-65, 5 figs. Jan. 5: Writer demonstrates value of coordination between costs and production department. Jan. 12: Questions relating to "productive hours" departmental expenses and establishment charges. Feb. 19: Premium bonus tickets, Jan. 26: Outlined system in practice. See also Eng. Production, vol. 4, nos. 66 and 67, Jan. 5 and 12, 1922, pp. 7-10 and 31-34, and (discussion), no. 68, Jan. 19, 1922, pp. 66-67. Paper read before Instn. Production Engrs.

CRANES

Electric Runabout. An Electric Runabout Crane. Eng. Production. vol. 4, no. 70, Feb. 2, 1922, p. 115, 1 fig. Describes trackless mobile cranes built by Ransomes, Sims & Jeffries, Ltd., Ipswich, England.

Locomotive. Increasing the Scope of Locomotive Cranes. Ry. Age, vol. 72, no. 6, Feb. 11, 1922, pp. 365-367, 4 figs. Experiences of Lehigh Valley demonstrates that a wide range of work can be handled advantageously.

CRANKCASES

Machining. Machining the Mark Crankcase, Fred H. Colvin. Am. Mach., vol. 56, no. 7, Feb. 16, 1922, pp. 256-257, 10 figs. Describes unusual milling cutter. Zylol used for detecting cracks. Methods of boring and reaming. Gages for final inspection.

CRANKSHAFTS

Forging. Radiagraph Aids in Forging Crankshafts, Fred E. Rogers. Forging & Heat Treating, vol.. 8, no. 1, Jan. 1922, pp. 26-28, 9 figs. Mechanically operated cutting torches for cutting heavy crankshafts, for preliminary cuts and cutting after cranks have been twisted through 120 deg.

Machining. A Crank Arm Turning Machine, P. M. Heldt. Automotive Industries, vol. 46, no. 2, Jan. 12, 1922, pp. 77-78, 5 figs. Describes device which simultaneously turns non-circular contours of all of the arms of an engine crankshaft.

CUTTING TOOLS

Diamond. Manufacture and Use of Diamond Cutting Tools, Ellsworth Sheldon. Am. Mach., vol. 56, nos. 4 and 6, Jan. 26 and Feb. 9, 1922, pp. 140-142, 5 figs. and 210-212, 8 figs. Jan. 26: Polishing or lapping the stone; wire-drawing dies. Feb. 9: Diamonds for drawing dies; methods of reducing diamonds to dust.

D

DIE CASTING

Methods. How Diecastings Are Produced, Herbert Chase. Autoıotive Insdutries, vol. 46, no. 1, Jan. 5, 1922, pp. 21-25, 8 figs. Describes methods followed and various types of die-casting machines employed. Characteristics of various alloys.

Pressure. Pressure Die Casting. Metal Industry (Lond.), vol. 20, no. 1, Jan. 6, 1922, pp. 1-3, 2 figs. Advantages of die casting over other forms of manufacture. Discusses half-round bearing dies.

DIESEL ENGINES

Flexibility. Diesel-Engine Flexibility, W. S. Burn. North-East Coast Instn. Engs. & Shipbuilders advance paper, no. 3228-P, for meeting Jan. 6, 1922, 40 pp. 22 figs. Investigation of flexibility of Diesel engine with view to its application to direct-driven Diesel locomotive.

Manufacture. Production of Cylinders, Pistons and Segments for Combustion Engines (Fabrication des cylindres, pistons et segments des moteurs à combustion). L'Ouvrier Moderne, vol. 4, no. 10, Jan. 1922, pp. 407-410, 2 figs. Choice and treatment of metals used in manufacture for Diesel engines.

Marine, Nobel 1600 B.H.P. Nobel-Diesel Marine Engine, George J. Steinheil. Engineer vol. 133, nos. 3448 and 3449, Jan. 27 and Feb. 3, 1922, pp. 91-93, 5 figs. partly on p. 102, and 126-128 , 6 figs. Describes latest product of Swedish Nobel-Diesel Co., Ltd., at Nynashamn. Engine is of two-cycle single-acting direct reversible crosshead marine type with 2,000 i.h.p. and giving mechanical efficiency of 80 per cent. Result of official trials.

DRAINAGE

Canadian Hydrometric Survey. Atlantic Drainage (South of St. Lawrence River), K. H. Smith. Can. Dept. of Interior, Dominion Water Power Branch, no. 29, 142 pp. 1 fig. Report of the Dominion Hydrometric Survey covering Nova Scotia, New Brunswick and Prince Edward Island, and Southwestern Quebec, for climatic years 1918-19 and 1919-20.

Canadian Hydrometric Survey. Pacific Drainage, R. G. Swan. Can. Dept. of Interior, Dominion Water Power Branch, no. 30, 281 pp., 2 figs. on supp. plates. Report of the Dominion Hydrometric Survey covering drainage in British Columbia and Yukon Territory, for climatic year 1919-20.

St. Lawrence and Southern Hudson Bay Drainage, S. S. Scovil. Can. Dept on Interior, Dominion Water Power Branch, no. 28, 1921, 85 pp., 1 fig. Report of the Dominion Hydrometric Survey covering drainage in Ontario for climatic year 1919-20.

DRILLING MACHINES

Heavy-Duty. Economy of Heavy-duty Drilling. Machinery (Lond.), vol. 19, no. 486, Jan. 19, 1922, pp. 472-477, 15 figs. Deals with the use of Colburn heavy duty drilling machine for work where heavy cuts are required.

Jigs. Dividing Drill Jigs, Hubert Bentley. Eng. & Indus. Management, vol. 7, no 1, Jan. 5, 1922, pp. 6-7, 4 figs. Engagement or disengagement of feed mechanism actuated by friction disks.

Multiple-Spindle. Some Special Machines for Intensive Production. Eng. Production, vol. 4, no. 68, Jan. 19, 1922, pp. 52-56, 7 figs. Describes different types of multiple-spindle drilling machines developed by Defiance Machine Works, Defiance, Ohio.

Radial. Recent Machine Tool Developments. Joseph Horner. Engineering, vol. 113, no. 2927, Feb. 3, 1922, pp. 126-128, 13 [illegible] figs. 8-11 6-in. radial drilling machine constructed by James, Archdale & Co., Ltd., Birmingham, England.

DRILLS

Twist, High Speed. Making the Latrobe High-Speed Twist Drill, S. Ashton Hand. Am. Mach. vol. 56, no. 7, Feb. 16, 1922, pp. 246-248, 9 figs. Steel rolled to obtain greatest density at points of wear. Flutes milled after twisting. Drills and shanks assembled by unusual methods.

DROP FORGING

Die Blocks. Die Blocks as Seen by the Drop Forge Plant, A. A. Blue. Forging & Heat Treating, vol. 8, no. 1, Jan. 1922, pp. 34-36. Qualities desired in a die block by various members of a drop-forge organization. Brief review of present practice and summary of established methods.

Die Blocks for Drop Forge Plant. Ry. Jl., vol 28, no. 2, Feb. 1922, pp. 15-16. Desirable qualities of a die block. Brief review of present practice.

Fiber Stresses in Die Blocks, Leslie Aitchison. Forging & Heat Treating, vol. 8, no. 1, Jan. 1922, pp. 36-38, 2 figs. Emphasizes the appreciation that is given in England to the direction of the grain in die block with relation to maximum work to be done by the impression. Except from address delivered before Assn. Drop Forgers & Stampers.

Stamps. Friction Lifters for Drop Stamps. W. H. Snow. Engineer, vol. 133, nos. 3446 and 3447, Jan. 13 and 20, 1922, pp. 34-36 and 60-62, 13 figs. Describes modified kick stamps, board drop stamps, and clutch-operated lifters.

Variables in. Variables in Drop Forge Practice, J. H. Nelson. Automotive Industries, vol. 46, no. 6, Feb. 9, 1922, pp. 274-276. Results of experiments in heat treatment of finished forgings; outlines five definite conclusions arrived at. Author states that there are seven possibilities of difference between drop forgings that are apparently identical.

E

EDUCATION, INDUSTRIAL

Industries and Railroads. A Review of Industrial Education and Training. Mech. Eng., vol. 44, no. 2, Feb. 1922, pp. 87-92. Education and Training in the Industries, R. L. Sackett. Education and Training on Railroads, D. C. Buell. Discussion.

ELECTRIC CONDUCTORS

Sizes for Motor Circuits. Wire Sizes for Motor Circuits, Edgar P. Slack. Power, vol. 55, no. 4, Jan. 24, 1922, pp. 129-130, 1 fig. Size of conductors for motor circuits as required by Nat. Electrical Code.

ELECTRIC DRIVE

Wire Mills. Electric Drives For Wire Mills. Blast Furnace & Steel Plant, vol. 10, no. 1, Jan. 1922, pp. 64-67, 7 figs. General description of modern electric recently installed in Alabama City works of Gulf States Steel Co.

ELECTRIC FURNACES

Counterflow-Car-Type. Counterflow Car Type Electric Furnace, Horace Drever. Forging & Heat Treating, vol. 8, no. 1, Jan. 1922, pp. 47-49, 5 figs. Describes in detail a furnace annealing gray cast iron, using the recuperative principle. Will anneal 20 tons of stock per 24-hr. day at 1450 deg. Fahr.; high thermal efficiency.

Heroult Steel. New 7-Ton Heroult Furnace. Iron Age, vol. 109, no. 5, Feb. 2, 1922, p. 325, 1 fig. Details of design capable of employing mechanical instead of hand charging.

Steel. The Present Status of Electric Furnaces in Steel Making, Harry Etchells. West of Scotland Iron & Steel Inst. Jl., vol. 29, Part 2, Nov. Session 1921-1922, pp. 2-7 and (discussion) 7-11, 1 fig. on supp. plate. Discusses various types of electric furnaces, especially the arc, and advantages of electric steel.

ELECTRIC LOCOMOTIVES

Steam vs. Railway Electrification. Steam vs. Railway Electrification, Vincent Roven. Ry. Gaz., vol. 36, no. 1, Jan. 6, 1922, pp. 11-14, 3 figs. Some advantages which may result from substitution of electric for steam locomotive operation. Describes design of various classes of electric locomotives. Abstract of papers read before North-East Coast Instn. Engrs. & Shipbuilders. See also Engineering, vol. 113, nos. 2923 and 2924, Jan. 6 and 13, 1922, pp. 25-26 and 39-43, 13 figs. partly on supp. plate and on p. 48, and Electrician, vol. 88, no. 2277, Jan. 6, 1922, pp. 10-11, 1 fig.

STORAGE-BATTERY. Accumulator Locomotives for Steel Works. Iron & Coal Trades Rev., vol. 104, no. 2811, Jan. 13, 1922, pp. 43-44, 3 figs. Describes electric apparatus built by Sanderson Bibby Co.

ELECTRIC MOTORS, A.C.

COMMUTATOR. Single and Three-Phase Alternating-Current Commutator Motors with Series and Shunt Characteristics, Stanley Parker Smith. Engineer, vol. 133, no. 3448, Jan. 27, 1922, pp. 98-100, 3 figs. (Abstract.) Paper read before Instn. Elec. Engrs.

ELECTRIC MOTORS, D.C.

SPEED REGULATION. Speed Regulation and Stability of Direct-Current Motors, Scott Hancock. Elec. Jl., vol. 19, no. 2, Feb. 1922, pp. 46-50, 7 figs. Considers armature distortion; the various effects of shifting the brushes; now to help make the speed droop; etc.

ELECTRIC RAILWAYS

INSURANCE FOR. Insurance for Electric Railways. Elec. Ry. Jl., vol. 59, no. 2, Jan. 14, 1922, pp. 73-78. Discusses types of insurance applicable to railway organizations; an efficient aid in handling labor; affords opportunity for operating economies; suggestions for executive action.

ELECTRIC TRANSMISSION LINES

CALCULATION. An Example of Transmission Line Calculations, R. D. Evan and H. K. Sels. Elec. Jl., vol. 19, no. 2, Feb. 1922, pp. 53-59, 6 figs. Discusses determination of approximate voltage and size of conductor; transmission line constants; general circuit and loss formula constants; power circle diagram constants; loss circle diagram constants; efficiency circle diagram constants; etc.

FIELD TESTS AT 280,000 VOLTS. Field Tests at 280,000 Volts on Big Creek Transmission Line, R. J. C. Wood. Elec. World, vol. 79, no. 6, Feb. 11, 1922, pp. 277-280. 10 figs. Conducted to ascertain feasibility of using existing towers and standard insulators, magnitude of corona loss and charging current, and possibilities of flashover.

PROTECTIVE RELAYS. Protective Relays Applied to Transmission Systems, H. P. Sleeper. Elec. Jl., vol. 19, no. 2, Feb. 1922, pp. 50-52, 10 figs. Discusses radial systems and loop systems.

ELECTRICAL ENGINEERING

DEVELOPMENT, 1921. Electrical Engineering in 1921. Engineer, vol. 133, nos. 3447 and 3448, Jan. 20 and 27, 1922, pp. 62-64 and 94-96. Jan. 20: Developments in power stations, turbo-generators, converters, mercury-vapor rectifiers, transformers, electric motors and electric vehicles. Jan. 27: Railway electrification; water power; electrical instruments; switchgear; cables and transmission lines; electrically driven rolling mills; electric ships; electric welding; radiotelegraphy and radiotelephony.

ELECTRIC WELDING, ARC

CAR-WHEEL FLANGES. Three Years Experience in Welding Worn Foanges, E. B. Gunn. Elec. Ry. Jl., vol. 59, no. 5, Feb. 4, 1922, p. 196. Satisfactory results have been obtained; wheel mileage has been increased greatly at small cost and with no bad results from a safety standpoint. Paper read before Central Elec. Ry. Assn.

CAST IRON. Arc-Welding of Cast Iron, A. R. Allard. Machy. (N.Y.), vol. 28, no. 6, Feb. 1922, pp. 461-464, 6 figs. Use and application of methods for welding of cast iron by electric arc.

INCREASING WELDING SPEED. Increasing Welding Speed, H. R. Pennington. Welding Engr., vol. 7, no. 1, Jan. 1922, pp. 24-25. Speed of electric arc welding can be increased by increasing electrode diameter and coating electrodes. Paper read before Am. Welding Soc.

STEEL STRUCTURES. Electric Arc Welding in Steel Structures, James Caldwell. Engineering, vol. 113, no. 2925, Jan. 20, 1922, pp. 88-90, 4 figs. Gives examples of work done, and summary of test results to date, giving some idea of extent to which welds in steel structures can be relied upon. (Abstract.) Paper read before British Instn. Mech. Engrs.

ELECTRICAL MACHINERY

ARMATURE WINDINGS. The Design of Armature Windings for Direct-Current Dynamo-Electric Machinery, H. E. Dance. Instn. Elec. Jl., vol. 60, no. 304, Dec. 1921, pp. 51-57, 6 figs. Deals with electrical design of open circuit windings on high-voltage machines used in connection with arc lamps in series, and the brush open circuit generators; mechanical design; limiting factors in design; electrical balancing of windings; windings for special purposes; etc. (Abstract.)

ELECTRICITY

AM. RY. ENG. ASSN. COMMITTEE REPORT. Report of Committee XVIII—On Electricity. Am. Ry. Eng. Assn. Bul., vol. 23, no. 239. Sept. 1921, pp. 85-129. Electrical interference; water power; electrolysis; National Electric safety code; overhead transmission line construction; specifications for commercial sdhesive tape and for rubber insulating; tape for electrical purposes.

ELECTRODEPOSITION

BUILDING UP METAL PARTS. Building Up Worn Metal Parts by Electrodeposition, W. E. Hughes. Chem. & Met. Eng., vol. 26, no. 6, Feb. 8, 1922, pp. 267-269. Discussion of relative merits of copper, nickel and iron for building up worn bearings and other metal parts.

ELEVATORS

[illegible] Devices of the Continuous Type. Eng. World, vol. 20, no. 2, Feb. 1922, pp. 90-91, 11 figs. Described in [illegible]

POWER APPLICATION TO. Electric Power Application to Passenger and Freight Elevators, Harrison P. Reed. Am. Inst. Elec. Engrs. Jl., vol. 41, nos. 1 and 2, Jan. and Feb. 1922, pp. 57-67 and 152-164, 23 figs. Notes on history and service requirements; types of elevator machines and limitation of each; characteristics and limitations of d.c. and a.c. motors; elevator controllers; brakes and other safety accessories; power consumption. Paper prepared under auspices of Subcommittee on Elevators of Indus. & Domestic Power Committee.

EMPLOYEES' REPRESENTATION

SHOP COMMITTEES. How Shop Committee Function Under Depression, Lionel D. Edie. Indus. Management, vol. 63, no. 2, Feb. 1922, pp. 92-95. Account of what happened to shop committee of Int. Harvester Co., and how these committees have handled lay-offs and wage reductions. Record includes wage cut and 20 per cent decided entirely by shop committees.

EMPLOYEES, TRAINING OF

FOUNDRY WORKERS. Industrial Training for Foundry Workers, Thos. Vickers. Foundry Trade Jl., vol. 25, nos. 283 and 284, Jan. 19 and 26, 1922, pp. 42-44 and 63-65, Jan. 19. Gives historical review. Discusses the Worshipful Company of Founders; improvements necessary in modern foundry conditions; effort of Cast Iron Research Assn. to modernize foundry production; etc. Jan. 26: American system and a German scheme.

EMPLOYMENT MANAGEMENT

ANALYSES OF WORKING FORCE. How to Analyse the Working Force, Eugene J. Benge. Management Eng., vol. 2, no. 2, Feb. 1922, pp. 79-84, 8 figs. Notes on securing facts to establish labor policies and proper working conditions.

EYE EXAMINATIONS. Better Work and More Work per Man Through Better Sight, E. LeRoy Ryer and Willard B. Fisher. Indus. Management, vol. 63, no. 2, Feb. 1922, pp. 111-117, 2 figs. Industrial eye examinations and their importance in management.

PRINCIPLES INVOLVED. Increasing Man Power Through Management. L. W. Olson. Indus. Management, vol. 63, no. 2, Feb. 1922, pp. 88-91. Writer discusses cardinal principles involved in management of men.

TESTING MOTORMEN. Psychological Tests for Motormen, Alfred Gradenwitz. Elec. Ry. Jl., vol. 59, no. 4, Jan. 28, 1922, pp. 143-146, 13 figs. Discusses physical and psychological tests which must be passed by candidates for position of motormen in Berlin.

ENGINEERING SCHOOLS

NEWARK TECHNICAL SCHOOL. College of Engineering of the Newark Technical School. Chem. Age. (N.Y.), vol. 30, no. 1, Jan. 1922, pp. 11-14, 3 figs. Discusses origin and administration of college, co-operation with industry, chemical engineering instruction, etc.

ENGINEERS

CO-OPERATION OF CHEMISTS AND. The Co-operation of the Engineer and Chemist in the Control of Plants and Processes, G. M. Gill. Gas Jl., vol. 157, no. 3061, Jan. 11, 1922, pp. 82-86 and (discussion) 86-89, 8 figs. Deals with coal and refractory materials and outlines system which has been applied with object of standardizing quality of gas. Paper read at joint meeting of (British) Instn. Mech. Engrs. and Soc. Chem. Industry. See also Engineering, vol. 113, no. 2924, Jan. 13, 1922, pp. 57-59, 8 figs.

LICENSING. Licensing and Engineering Ethics, C. E. Waddell. Professional Engr., vol. 7, no. 1, Jan. 1922, pp. 8-9. Status of the expert witness contractor, manufacturer, salesman, college graduate and practising engineer.

EVAPORATORS

LIQUOR CONCENTRATION. The Concentration of Liquors by Evaporation, James Holmes. Chem. Trade Jl. & Chem. Engr., vol. 70, no 1807, Jan. 6, 1922, pp. 1-3. Notes on heat losses in evaporation; typical quadruple-effect performances; improvements in design of evaporators.

EXCAVATION, EARTH

AMERICAN METHODS. American Methods of Excavation, Albert Lakeman. Concrete & Constructional Eng., vol. 17, no. 1, Jan. 1922, pp. 13-23, 13 figs. Gives typical examples taken from schemes actually exucuted. dealing with following methods: Plough and scraper, derrick and skip, derrick and grab, trench digger, and steam shovel.

DRAGLINES, ELECTRIC VS. STEAM. Comparison of Electric and Steam Draglines at Miami, G. L. Teeple. Eng. News-Rec., vol. 88, no. 3, Jan. 19, 1922, pp. 96-99, 2 figs. Comparative Costs of operation of steam and electric draglines. Structural weaknesses determined.

EXHAUST STEAM

UTILIZATION. The Utilization of Exhaust Steam. Engineer, vol. 133, no. 3448, Jan. 27, 1922, pp. 109-110. Outline of two papers read before joint meeting of Instn. Elec. Engrs. and Instn. Heating & Ventilating Engrs., namely, Utilization of Exhaust Steam from Electric Generating Stations and Coal Economy, by Ingham-Haden; and Utilization of Waste Heat from Electric Generating Stations, by F. N. Whysall.

F

FACTORY MANAGEMENT

See Industrial Management.

FANS

MEASURING DELIVERY. Standardized Method of Measuring Fan Delivery, E. N. Fales. Am. Soc. Heat. & Vent. Engrs. Jl., vol. 28, no. 1, Jan. 1922, pp. 1-10, 7 figs. Discusses the method as applicable not only to cooling fans, but also to larger-type propeller fans where flow is not enclosed.

FLOOD [illegible]

MARSH LAND, CONSERVANCY OF. [illegible] Engineering, vol. 113, no. 2923 [illegible] Discusses protection of low-lying marsh lands [illegible] Notes on clay embankments [illegible] electric problems.

FLOW OF FLUIDS

COMMERCIAL PIPE LINES. [illegible] roughness, especially for very viscous liquids and in critical region between viscous and turbulent flow; and to determine correction factors for pressure drop around bends.

FLOW OF WATER

KUTTER'S FORMULA. Kutter's [illegible] Eng. & Contracting, vol. 57, no. 6, Feb. 8, 1922, p. 128. It is shown that apparent discrepancies introduced by use of modified form of formula for solution of problems ordinarily met are less than discrepancies introduced by difference of .001 in determinationof value of n.

PIPES. Flow of Water through Spiral Riveted Steel Pipe, F. W. Greve and R. R. Martin. Purdue University Publications of Eng. Depts., vol. 5, no. 2, July 1921, 32 pp. 11 figs. Data and results of investigation upon flow of water through 4, 6, 8 and 10-in. [illegible] made to determine (1) variation of friction loss with velocity, for flow both with and against laps: (2) variation in accuracy of four types of piezometer rings; (3) comparison of friction loss with that in cast iron pipes for like conditions of diameter and velocity.

FORGE PLANTS

STEAM AND BOARD HAMMERS. Comparison of Steam and Board Hammers, R. C. Jennings. Forging & Heat Treating, vol. 8, no. 1, Jan. 1922, pp. 28-29. Advocates board hammer for forging of light and medium heavy parts and steam hammer where considerable drawing or heavy forging is to be done.

FORGES

GAS FORGES. Use of Gas Forges in Repair Shops, J. L. Springer. Gas Age-Rec., vol. 49, no. 5, Feb. 4, 1922, pp. 133-134. Deals with temperature regulation, combustion gases, sulphur in burning gases, and bench forges.

FOUNDRIES

GRAY-IRON. Complete Huge Wisconsin Foundry. Foundry, vol. 50, no. 3, Feb. 1, 1922, pp. 89-98, 15 figs. Describes new plant of Fairbanks, Morse & Co., with capacity of 500 tons per day of gray-iron castings varying in weight from 1 lb. to 15 tons.

FREIGHT HANDLING

ERIE RAILROAD. Erie Adopts Direct Freight Delivery at New York. Ry. Age, vol. 72, no. 3, Jan. 21, 1922, pp. 233-234, 1 fig. Plan involves breaking bulk at Jersey City, N. J., and use of auto tracks, tractors and trailers and ferries.

FUELS

BAGASSE, CALORIFIC VALUE OF. The Calorific Value of Bagasse, P. H. Parr. Int. Sugar Jl., vol. 24, no. 277, Jan. 1922, pp. 13-18. Determines heating value for bagasse, its composition, etc. Gives some comparative figures for wood.

ECONOMY. A Session on Fuel Economy. Mech. Eng., vol. 44, no. 2, Feb. 1922, pp 112-113 and 118. Discussion of four papers at A.S.M.E., meeting, namely, Boiler Plant Efficiency, by Victor J. Azbe; Boiler and Furnace Economy, D. S. Jacobus; Fuel Saving in Relation to Capital Necessary, Joseph Harrington; and Fuel Saving in Modern Gas Producers and Industrial Furnaces, W. B. Chapman. Brings out many experiences in economic boiler and furnace operation, leading to great fuel savings.

LOW-GRADE. Recent Fuel Investigations. Power Plant Eng., vol. 26, no. 3, Feb. 1, 1922, pp. 162, 164. Experiments conducted to determine feasibility of utilizing lower-grade fuels for steaming purposes.

See also Oil Fuel; Pulverized Coal.

FURNACES

COMBINATION WELDING AND PREHEATING. Combination Welding—Preheating Furnace, F. M. Gloyd. Forging & Heat Treating, vol. 8, no. 1, Jan. 1922, pp. 84-85 and 89, 7 figs. Methods at plant of A. A. Simonds & Sons Co., Dayton. Ohio, using stoker-fired furnace for preheating and welding. Special tongs and metric clock increase production materially.

FURNACES, HEATING

FORGINGS. Heating Furnaces For Forgings, C. Fischer. Blast Furnace & Steel Plant, vol. 10, no. 1, Jan. 1922, pp. 94-95, 3 figs. Discusses utilization of waste gases from heating furnaces, including direct preheating of steel by waste gases.

FUSION WELDING

CASTINGS. Utilizing Fusion Welding on Castings, H. S. Rawdon. Iron Trade Rev. vol. 70, no. 4, Jan. 26, 1922, pp. 274-276. Includes table summarizing mechanical properties of low-carbon cast steel prepared by thermit process, and by arc-fusion. Discussion of paper entitled Fusion Welding, by S. W. Miller, presented at Am. Iron & Steel Inst.

G

GAGES

ADJUSTABLE LIMIT. The Wickman Adjustable Limit Gauge for Taps. Engineering, vol. 113, no. 2926, Jan. 27, 1922, pp. 100-102, 13 figs. Describes adjustable thread caliper gage which enables screws and externally threaded part to be controlled within any desired limits of accuracy in pitch, effective diameter, etc. Its use for tap inspection.

MULTIPLE-SPLINE, GRINDING. Grinding Multiple Spline Gauges. Machinery (Lond.) vol. 19, no. 485, Jan. 12, 1922, pp. 449-450, 3 figs. Describes method of grinding multiple-spline gages having six or more splines, which has proved successful in practice.

SNAP, SETTING MACHINE FOR. Snap Gauge Setting Machine. Machinery (Lond.), vol. 19, no. 485, Jan. 12, 1922, pp. 439-440, 3 figs. Range of machine covers settings from ½ up to 10 in., and the sensitiveness is to 0.0001-in.

GAS ANALYSIS

STACK AND FUEL. Graphical Treatment of Stack Gas Analysis and Fuel Gas Analysis, W. Trinks. Blast Furnace & Steel Plant, vol. 10, no. 1, Jan. 1922, pp. 50-58, 5 figs. Gives most important phases of work regarding charts introduced by Wa. Ostwald and laid out in book called "Beiträge zur graphischen Feurungstechnik," on calculation for stack has analysis for producer gas, natural gas, by-product tar, coke-oven gas, and for coal.

GAS PRODUCERS

HOT-BLAST APPLICATION. Using Hot Air in Gas Producers for Fusing Ash (L'Emploi du vent chaud dans les gazogènes à fusion des cendres), A. Dessemond. Le Génie Civil, vol. 79, no. 26. Dec. 24 1921, pp. 561-564, 1 fig. Describes installation of Société des Houillères de St. Etienne, showing success of system with fuel containing up to 60 per cent ash, as well as with heterogeneous fuels.

GASES

CLEANING. Rotary-Type Gas Filter. Mech. Eng., vol. 44, no. 2, Feb. 1922, p. 126, 1 fig. Describes process intended to be used for removing dust, tar, oil and similar impurities from gases and vapors, developed by Freytag-Metzler and tested by E. Stach and Dr. Alexi. Translated from Zeit, des Vereines deutscher Ingenieure, vol. 65, no. 49, Dec. 3, 1921, pp. 1265-1267, 7 figs.

GEAR CUTTING

FIXING AND RELEASING OF BLANKS. Rapid Holding and Releasing of Gear Blanks, Fred Horner. Can. Machy., vol. 27, no. 5, Feb. 2, 1922, pp. 40-41 and 46, 10 figs. Holding with spring collets of external or internal type; use of draw-back rod, etc.

WORM-GEAR MACHINE. A New Worm Gear Generating Machine. Engineer, vol. 133, no. 3447, Jan. 20, 1922, pp. 78-79, 9 figs. New Machine by Smith & Coventry, Ltd., Manchester, England of tangent feed pattern, more particularly adapted to generation of single wheels or wheels in small numbers by means of less expensive fly cutter.

GEARS

AUTOMOBILE, MACHINING. Cost-Reducing Tooling Equipments, Ralph E. Flanders. Machinery (Lond.), vol. 19, no. 485, Jan. 12, 1922, pp. 441-444, 10 figs. Machines and tooling equipments used for performing turning, boring, facing, and recessing operations on automobile gears.

Tooling Equipment for Automobile Gears and Ball Races, Ralph E. Flanders. Machy. (N.Y.), vol. 28, no. 6, Feb. 1922, pp. 447-451, 14 figs. Describes jobs performed on Fay automatic lathes and operations on double-spindle flat turret lathes and Hartness automatic lathes.

GRINDING HARDENED TEETH. Grinding Hardened Gear Teeth. Eng. Production, vol. 4, no. 67, Jan. 12, 1922, pp. 42-44, 6 figs. Describes machine for finish grinding spur gear teeth to within definite limite of accuracy, and without producing scrap.

HIGH-CARBON, RECLAIMING. Reclaiming High Carbon Gears, R. L. Dowdwll. Am. Soc. for Steel Treating Trans., vol. 2, no. 4, Jan. 1922, pp. 320-322, 8 figs. Describes method by which these gears could be reclaimed by heat treatment which would give them a tough core with a hard case by varying the internal structures without altering carbon content.

HOT-ROLLING. Forming Gears by Hot Rolling, Reginald Trautschold. Iron Trade Rev., vol. 70, no. 6, Feb. 9, 1922, pp. 396-399, 6 figs. Independent application of power to die roll and gear blank and synchronization of their rotation are said to be factors contributing to success of gear-rolling processes.

INVOLUTE. Gear Tooth Shapes, E. W. Miller. Am. Mach., vol. 56, nos. 4 and 5, Jan. 26 and Feb. 2, 1922, pp. 129-132 and 168-172, 26 figs. Study of fundamentals in principles of involute gearing in endeavor to find a suitable standard form and pressure angle.

The Evolution of the Involute Gear Tooth—XI, A. Fisher. Machy. (Lond.), vol. 19, no. 487, Jan. 26, 1922, pp. 513-517, 6 figs. Involute pitch and pressure-angle permutability.

SPUR, INSPECTION OF. Inspection of Spur Gears, D. Vaughn Waters. Machy. (N.Y.), vol. 28, no. 6, Feb. 1922, pp. 465-466, 4 figs. Describes practice of Gould & Eberhardt, Newark, N.J., in inspecting spur gears, with particular reference to uniformity of tooth spacing and concentricity of pitch circle relative to axis of gear.

TRANSMISSION. Transmission (Les Transmissions), Legrand-Ribet. L'Outillage, vol. 241, no. 1, Jan. 7, 1922, pp. 8-17, 44 figs. Discusses dimensions, speed of transmissions, bearings, brakes, pulleys, etc.

VARIABLE-SPEED. Gears and Mechanisms at Variable Speed (Les embrayages et les mécanismes en mouvement varié.), H. Meuris. Annales des Travaux Publics de Belgique, vol. 22, Dec. 1921, pp. 993-1006, 4 figs. Distinguishes between those where starting and stopping occurs rarely, and where it occurs frequently, and studies useful work and lost work mathematically.

GRAVEL

FROZEN, COLD-WATER THAWING OF. Cold-Water Thawing of Frozen Gravel, Edward E. Pearce. Min. & Sci. Press, vol. 124, no. 5, Feb. 4, 1922, pp. 154-156, 3 figs. Describes new process, showing methods employed and results obtained by it on a piece of dredging ground in Candle creek, Alaska.

GRINDING MACHINES

PRACTICE. Grinding Machines and Practice—II—VII. Mech. World, vols. 70 and 71, nos. 1812, 1816, 1819, 1821, 1824 and 1829, Sept. 23, Oct. 21, Nov. 11, 25, Dec. 16, 1921 and Jan. 20, 1922, pp. 238-239, 318-320, 378-379, 418-419, p. 478 and pp. 42-43, 32 figs. Sept. 23: Discusses grain and grade; bonds used for vitrified silicate, elastic and other wheels; and natural and artificial abrasives. Oct. 21: Selection of wheels for a given job; hardness; speeds; dressing and trueing wheels; etc. Nov. 11 and 25; Design of wheel mountings. Dec. 16; Discusses the question of protection hoods and the production of sparks. Jan. 20: Cylindrical grinding machines, and wheel-spindle mounting for plain grinding machines. (To be continued.)

WHEEL-TRUEING ATTACHMENT FOR THREAD. Wheel-Trueing Attachment for Screw-Thread Grinding. Engineering vol. 113, no. 2925, Jan.20, 1922, p. 76, 4 figs. on p. 78. Describes new attachment brought out by Precision & Thread Grinder Mfg. Co., Philadelphia, Pa., primarily intended for use with maker's multi-graduated precision thread grinder.

H

HARDNESS

TESTING. Ball Hardness Testing of Semi-Steel (L'essai de Dureté à la bille sur la Fonte aciérée), M. Portevin. Fonderie Moderne, no. 11, Nov. 1921, pp. 318-321, 2 figs. Establishes empiric, formulas and gives advantages of Brinell test.

HEAT TREATING

ELECTRIC. Economics of Electric Heat Treating, E. F. Collins. Forging & Heat Treating, vol. 8, no. 1, Jan. 1922, pp. 76-81, 5 figs. Method of electric heat transmission and delivery to charge: importance of insulation in various types of furnaces.

HEATING, ELECTRIC

RESIDENCES. Electric Heating of Residences, Edgar Allan Loew. University Wash. Eng. Experiment Station Bul., no. 15, Dec. 1921, 44 pp., 8 figs. Experiments and reports on electric house heating. Experiences with domestic heating in Tacoma, Wash., and conclusions reached. Comparison of heating electrically and by means of coal, and possibilities in use of surplus, off-peak and seasonal power.

THERMAL PROCESSES. Electric Heat for Thermal Processes, E. F. Collins. Jl. Indus. & Eng. Chem. vol. 14, no. 2, Feb. 1922, pp. 101-104, 6 figs. Discusses heat generation and heat transmission, and gives examples of the various installations applying electric heat industrially.

HEATING, FACTORY

ANALYSIS. An Analysis of Factory Heating, M. C. W. Tomlison. Factory, vol. 28, no. 2, Feb. 1922, pp. 162-164, 4 figs. Twelve ways to get more heat from less coal.

HIGHWAYS

RECENT DEVELOPMENTS. Recent Developments in the Highway Field. Eng. & Contracting, vol. 57, no. 5, Feb. 1, 1922, pp. 103-108. Abstracts of papers presented before Good Roads Congress by Am. Road Builders Assn. as follows: Highway Research, W. K. Hatt; Single Track Concrete Roads for the Average County, P. C. McArdle; Utilizing Small Stream Valleys for Traffic Routes, Jay Downer; Suggestions for Future Asphalt Specifications, Leroy M. Law: Paving Widths for Highways Serving Large Cities, William F. Cavanaugh; The use of Local Mineral Aggregate in Bituminous Macadam Roads, W. A. Welch; The Bates Experimental Road of Illinois Highway Department, Clifford Older; and Uniform Legislation as Affecting Highway Traffic and Highway Transport, P. C. Fenner.

HOISTS

ELECTRIC. Factors Affecting Installation of Electric Motors for Hoisting, Gordon Fox. Elec. World, vol. 79, no. 4, Jan. 28, 1922, pp. 171-173, 1 fig. Methods of determining size of motors required. Various types of skip hoists and their [illegible] advantages and disadvantages of a.c. and d.c. drives for skip hoists.

HYDROELECTRIC DEVELOPMENTS

ST. LAWRENCE RIVER. St. Lawrence Navigation and Power Investigation. Can. Engr., vol. 42, no. 3, Jan. 17, 1922, pp. 139-145, 1 fig. Details of double deve- [illegible] New York & Ontario Power Co. Suggestions [illegible] in vicinity of Waddington. Proposed [illegible]

HYDROELECTRIC PLANTS

BATHURST, N.B. Hydro-Electric Developments Near Bathurst, N.B., James Dick. Can. Engr., vol. 42, no. 5, Jan. 31, 1922, pp. 181-185, 10 figs. Construction details of plant at Grand Falls, Nepisiguti River. 15 mi. of standard gage [illegible] reinforced concrete. Transmis- [illegible]

DESIGN. Hydro-Electric Developments, W. M. White. Denki Gakkwai Zasshi (Jl. Inst. Elec. Engrs. Japan). No. 402, Jan. 1922 pp. 21-31, 6 figs. Deals with design of power house and dam, tunnels, canals, pipe lines, turbines, draft tubes and tail race.

QUEENSTON-CHIPPAWA. First Unit for Queenston-Chippawa Water Power Plant Opened. Eng. News-Rec., vol. 88, no. 3, Jan. 19, 1922, pp. 110-111. Includes views of completed hydroelectric development around Niagara Falls in Ontario.

SOUTH AFRICA. Description of the Hydroelectric Power Plant Installed at Howick Falls, H. W. Miller. So. African Instn. of Engrs. Jl., vol. 20, no. 4, Nov. 1921, pp. 62-71, 6 figs. Describes work connected with construction of concrete diversion weir, a pipe line of some 600 ft. in length with upper section 34 in. diameter by 200 ft. long, the power house and machinery, etc. See also So. African Eng., vol. 32, no. 12, Dec. 31, 1921, pp. 242-243.

TRASH-RACK RAKE. Mechanical Trash-Rack Rake, I. W. Jones. Power, vol. 55, no. 4, Jan. 24, 1922, pp. 131-132, 3 figs. Describes rack rake developed by author, consisting of motor-operated car mounted on wheels designed to travel on rails inlaid in rack platform. Rake is supported by light structural-steel framework and operated by four steel cables.

HYDRAULIC TURBINES

GOVERNORS. Hydraulic Turbine Governors, W. R. Kepler. Elec. Jl., vol. 19, no. 2, Feb. 1922, pp. 60-68, 12 figs. Discusses limitation of speed to suit conditions demanded by character of load. Governing element may be grouped into three sections, (1) flyballs, valve and compensating device, (2) pressure system and (3) mechanism for applying energy of pressure system to change amount of water through turbine.

I

ICE MANUFACTURE

REFRIGERATING PROCESS. Voorhees' Refrigerating Economies, Gardner T. Voorhees. Ice & Refrigeration, vol. 62, no. 1, Jan. 1922, p. 22, 2 figs. Discusses the multiple-effect receiver, multiple-effect compressor, compressed exhaust-steam process, double-freezing can ice process, and the non-cracked ice and fore-cooler process. Paper read before Nat. Assn-Practical Refrig. Engrs.

ILLUMINATION

COMMITTEE REPORTS. Illumination Items by the Lighting and Illumination Committee. Am. Inst. Elec. Engrs. Jl., vol. 41, no. 2, Feb. 1922, pp. 149-151, 4 figs. Notes on preliminary report by P. W. Cobb, on influence of illumination levels upon speed of vision; electric sign lighting; and report of Committee on Elimination of Waste in Industry of Am. Eng. Council on accidents due to eye defects.

IMPACT

BARS, DURATION OF. Duration of Impact of Bars, Erwin W. Tschudi. Physical Rev., vol. 18, no. 6, Dec. 1921, pp. 423-430, 4 figs. Experiments show that duration of impact is not a linear function of length of colliding bars, a fact directly contrary to compressional wave theory.

INDICATORS

STEAM-ENGINE. The Steam-Engine Indicator Power, vol. 55, nos. 4, 5 and 6, Jan. 24, 31 and Feb. 7, 1922, pp. 142-144, 6 figs., 182-184, 10 figs, and 224, 3 figs. Jan. 24: What a reducing rig is and how it is made. Jan. 31: Reducing rigs on modern engines, and reducing wheels and cylinder connections. Feb. 7: Checking reducing rig for errors.

INDUSTRIAL MANAGEMENT

INVENTORY METHODS. How to Cut Cost Corners Through Inventory, W. M. Romig. Indus. Management, vol. 63, no. 2, Feb. 1922, pp. 86-87, 2 figs. How well-managed inventory methods help to stabilize profits.

JOB ANALYSIS. Job Analysis as a Factor in Cost Reduction, Richard S. Uhrbrock. Indus. Management, vol. 63, no. 2, Feb. 1922, pp. 100-102. Qualifications of the analyst and method of approach.

OVERHEAD DISTRIBUTION. Lightening the Factory Burden, Clinton W. Bennett. Indus. Management vol. 63, no. 2, Feb. 1922, pp. 103-106, 5 figs. Distribution of overhead for analysis and control.

PRODUCTION CONTROL. Production Control by Graphics. Machinery (Lond.), vol. 19, no. 484, Jan. 5, 1922, pp. 405-412, 13 figs. Describes system employing graphic charts for controlling shop operations in plant making cotton looms and automatic attachments for looms.

The Measurement of Human Work, Walter N. Polakov. Management Eng., vol. 2, no. 2, Feb. 1922, pp. 91-93, 1 fig. The Gantt Graphic method of controlling production is claimed to be only one on a correct unit of measurement.

PRODUCTION PLANNING. Production Planning at the Dennison Plant. Factory, vol. 28, no. 2, Feb. 1922, pp. 159-162, 4 figs. Describes system which controls made-to-order goods almost entirely, where each order requires special attention. Its main object and accomplishment is to co-ordinate all departments to secure most satisfactory ultimate results.

SALES ORGANIZATION. Sales organization and Methods, Willard W. Freeland. Taylor Soc. Bul., vol. 6, no. 6, Dec. 1921, pp. 244-251 and (discussion) pp. 251-254. Second report of committee on sales questionnaire, purpose of which was to obtain information about form of organization of sales departments, extent to which engineering phases were recognized and scientific planning and scheduling attempted, and methods of control of important portions of work of distribution organization.

SMALL SHOP OVERHEAD. Minimum Shop Operation Without Loss, D. S. Cole. Indus. Management, vol. 63, no. 2, Feb. 1922, pp. 96-97, 1 fig. Describes how small industrial plant operated plant during period of curtailed manufacturing operations without allowing overhead or fixed expense to force losses.

See also Time Study

INDUSTRIAL ORGANIZATION

DRAFTING ROOMS. The Organization of a Jig and Tool Drawing Office, H. Varley. Eng. & Indus. Management, vol. 7, no. 2, 1922, pp. [illegible], 4 figs. Development and scope of tool office; size of tool drawing office; types of jig and tool office; relationship with productive departments; layout of office organization; and division of work.

KNITTING MILLS. The Organization of Knitting Mills, Carl M. Bigelow. Management Eng., vol. 2, no. 2, Feb. 1922, pp. 111-116, 15 figs. Standardizing work of planning department.

INJECTORS

EXHAUST STEAM, LOCOMOTIVE. An Improved Exhaust Injector for Locomotives. Ry. Engr., vol. 43, no. 504, Jan. 1922, pp. 9-10 and 12, [illegible] figs. Describes advantages of new J type injector made by Davies & Metcalfe, Romiley.

INSTRUMENTS

CONTROL. The Organization of Instrument Control in Industrial Plants, Frederick J. Schlink. Management Eng., vol. 2, no. 2, Feb. 1922, pp. 67-72, 4 figs. Deals with factors in instrument control and describes some typical installations. Qualifications and duties of inspectors. Calibration and tagging of instruments. Installation, repair and maintenance.

INSULATING MATERIALS

BREAKDOWN TESTS. Breakdown Tests on Insulating Materials, N. A. Allen. Elec. Rev. (Lond.), vol. 89, no. 2301, Dec. 30, 1921, pp. 876, 3 figs. Describes method using some form of guard ring by which more accurate results are obtained providing a fairer test of the behavior of the material under uniform electric stress.

PROPERTIES. Properties and Characteristics of Insulating Materials, R. T. Fleming. Instn. Elec. Engrs. Jl., vol. 60, no. 304, Dec. 1921, pp. 58-64, 4 figs. Deals with manufacture and properties of porcelain; mica insulation, and physical properties of mica; fibrous insulation; liquid insulation, including transformer and switch oils and varnishes. (Abstract)

VARNISH. Tests on Insulating Varnish, W. S. Flight. Elec. Rev. (Lond.), vol. 89, no. 2298, Dec. 9, 1921, pp. 771-773. Describes tests made as to drying, aging, dielectric strength, acidity, oil-resisting properties, sticking qualities, softening temperature, and thermal conductivity.

INTERNAL-COMBUSTION ENGINES

LUBRICATING OILS. Lubricating Oil, W. R. G. Atkins. Automobile Engr., vol. 11, no. 158, Dec. 1921, pp. 450-452. Factors affecting its consumption in internal-combustion engines.

RESEARCH. Recent Research Work on the Internal Combustion Engine, Harry R. Ricardo. Automotive Industries, vol. 46, no. 3, Jan. 19, 1922, pp. 126-133, 15 figs. Discusses effect of latent heat of vaporization, mean volatility, temperature, pressure, dilution, mixture strength, stratification and other factors upon combustion, and especially the detonation of various fuels. Condensed from paper read before Soc. Automotive Engrs.

See also Airplane Engines; Automobile Engines; Diesel Engines; Oil Engines; Semi-Diesel Engines.

IRON

CHARCOAL, MANUFACTURE OF. Manufacture of Charcoal Iron and Charcoal Iron Boiler Tubes, W. H. S. Bateman. Southern & Southwestern Ry. Club. vol 16, no. 6, Nov. 17, 1921, pp. 10-17 and (discussion) 17-21. Describes processes of manufacture and method of rolling skelp for tubes.

IRON ALLOYS

SILICON-IRON. Silico-Thermy and its Practical Application, C. A. Heise. Iron Age, vol. 109, no. 5, Feb. 2, 1922, pp. 337-338, 5 figs. German iron-silicon castings of "thermisilid" made by thermal reactions. Silicides which are formed. Properties of new alloy. Paper read by Richard Walter before German Met. Soc.

IRON ORE

BRIQUETTING AND SINTERING OF METAL AND. The Briquetting and Agglomeration of Fine Ores (Die Stückigmachung von Feinerzen), H. Biernbaum. Metall u. Erz. vol. 19, no. 1, Jan. 8, 1922, pp. 1-8 and (discussion), pp. 8-19, 10 figs. Discusses different briquetting processes with and without additions; and sintering and agglomerating processes, including the converter and Dwight-Lloyd processes.

MAGNETIC CONCENTRATION. Magnetic Concentration of Iron Ore, Edward W. Davis. Univ. of Minn. Bul., vol. 24, no. 23, Dec. 21, 1921, 138 pp., 73 figs. Physical structure of typical iron ores; standard ore-dressing practice; magnetic roasting and concentration; standard testing methods for magnetic ores; flow sheets for iron ore concentration.

ONTARIO, DEPOSITS IN. Mattagami Iron Ore Deposits. Iron & Steel of Can., vol. 4, no. 12, Jan. 1922, pp. 10-11. Describes siderite deposits situated at Grand Rapids on Mattagami river in Ontario, and gives some analysis of samples.

SMELTING TITANIFEROUS. The Smelting of Titaniferous Iron Ores, W. M. Goodwin. Roy. Canadian Inst. Trans., vol. 13, no. 30, Sept. 1921, pp. 35-49, 2 figs. Reviews literature on the subject and discusses tests made at laboratory of Queens University to find a method of smelting suited to titaneferous iron ores.

IRON, PIG

PIG-BREAKING MACHINE. A New Pig-Breaking Machine. Foundry Trade Jl., vol. 24, no. 280, Dec. 29, 1921, p. 519, 2 figs. Describes patent of E. Roper & Co., of Keighley, made either for belt or direct motor drive.

SYNTHETIC. Recarburizing Steel for Iron Foundry Use. Foundry Trade Jl., vol. 25, no. 282, Jan. 12, 1922, pp. 29-30. Describes series of trials made at Rombach, and gives analyses of cupola-melted steel scrap, billets and slags, also typical analyses of recarburized Bessemer steel and Bessemer steel recarburized with charcoal. From Stahl u. Eisen.

L

LABOR TURNOVER

ABSENTEEISM. Absenteeism: a Quantative Study, J. D. Hackett. Management Eng., vol. 2, no. 2, Feb. 1922, pp. 85-90. Factors from experience on causes, occurrence, and duration of absenteesim and condition of absentees.

LABORATORIES

ENGINEERING WORKS. An Engineering Works Laboratory. Engineering, vol. 113, no. 2924, Jan. 13, 1922, pp. 34-36, 4 figs. Describes laboratory and equipment of W. H. Allen Sons & Co., Ltd., Bedford, England, manufacturers of high-speed engines, turbines, oil engines, electrical machinery, etc.

LATHES

SCROLL-FORMING. Lathe Formers, V. Gartside. Machy. (Lond.), vol. 19, no. 487, Jan. 26, 1922, pp. 505-507, 7 figs. Discusses scroll-turning lathes.

TURRET. Turret Lathe Tooling. Machy. (Lond.), vol. 19, no. 487, Jan. 26, 1922, pp. 500-501, 4 figs. Equipment for machining differential gear housings on turret lathes.

WHEEL. A New 48-in. Wheel Lathe. Ry. Gaz., vol. 35, no. 22, Nov. 25, 1921, pp. 815-816, 2 figs. Describes a modern wheel lathe characterized by abundance of driving power, rigidlity, efficient operating facilities, and high output, made by Noble & Lund, Ltd., Felling-on-Tyne.

LEATHER INDUSTRY

RESEARCH. Research in Leather Manufacture, Arthur W. Thomas. Mech. Eng., vol. 44, no. 2, Feb. 1922, p. 116. Describes work which has been done and points out that there is a great field in tanning industry, by prosecution of scientific research, to eliminate unnecessary wastes due to lack of knowledge of reactions.

LIGHTHOUSES

AERIAL. Aerial Lighthouses. Flight, vol. 14, no. 4, Jan. 26, 1922, pp. 52-54, 3 figs. Describes the 1,000,000,000-c.p. lighthouse which is being erected at Dijon for aerial routes between Paris and Algiers, Italy and Switzerland, made by Barbier, Bernard and Turenne, of Paris.

LIGHTING

ARTIFICIAL DAYLIGHT. Recent Improvements in the Sheringham Daylight, S. H. Groom. Illuminating Engr., vol. 14, no. 9, Nov. 1921, pp. 215-218, 4 figs. Principles upon which Sheringham daylight is based and recent improvements made.

LIGHTNING ARRESTERS

DEVIATIONS FROM STANDARD PRACTICE. On Deviations from Standard Practice in Lightning Arresters, E. E. F. Creighton. Am. Inst. Elec. Engrs., Jl., vol. 41, no. 2, Feb. 1922, pp. 99-106, 1 fig. Author endeavors to answer questions of practice and criticism of arresters brought out by investigation conducted by Protective Devices Cómmittee. Discusses use of no arresters from three standpoints. Inspection and repair of aluminum arresters.

LIGNITE

NORTH DAKOTA. Lignite in the Western Part of the Fort Berthold Indian Reservation South of Missouri River, North Dakota, Clyde Max; Bauer and Frank A. Herald. U.S. Dept. of Interior, Geological Survey, Bul. 726-D, 1921, pp. 109-172, 29 figs. Describes briefly geography and general geology and discusses in detail lignite beds, physical and chemical properties. quantity available, distribution, etc.

LIME

USES. An Outline of the Uses of Lime, M. E. Holmes. Chem. & Met. Eng., vol. 26, no. 7, Feb. 15, 1922, pp. 294-300. Discusses chemical, construction and agricultural uses, and gives chart showing the many functions and uses of lime. Paper read before Am. Inst. Chem. Engrs.

LIQUIDS

EMULSIFIED, PUMPING. Pumping Liquids and Light Bodies by Emulsifying (Pompage des liquides et des corps légers par émulsion), Henry Béduwé. Revue Universelle des Mines, vol. 11, nos. 1 and 2, Oct. 1 and 15, 1921, pp. 57-64 and 155-160, 7 figs. Oct. 1: Describes application and operation of air lift pump and experiments made by Westinghouse Air Brake Co. Oct. 15: Discusses industrial applications of emulsion pump, pumping by compressed air, etc.

LOCOMOTIVE BOILERS

PULVERIZED-COAL-FIRED. Pioneer Boilers fired with Pulverized Coal, F. P. Coffin. Combustion, vol. 6, no. 2, Feb. 1922, pp. 74-77 and 95, 2 figs. Describes the Bettington boiler, designed for firing with powdered coal or coal dust; the Erie City Iron Works boiler, designed by Aero Pulverizer Co.; and the American Locomotive Works boiler. (Abstract).

TUBE FRACTURES. Notes on Fractures in Locomotive Boiler Tubes, Henry Fowler. Faraday Soc. Trans., vol. 17, part 1, no. 49, Dec. 1921, pp. 82-90, 11 figs. Results of investigation of large tubes of boiler on Midland Railway showing brittleness and fractures.

LOCOMOTIVES

ADHESION AND RACK. Adhesion and Rack Locomotive for Sumatra. S. Abt. Ry. Age, vol. 72, no. 4, Jan. 28, 1922, pp. 263-266, 7 figs. Describes 0-10-0 type superheater four-cylinder compound locomotive of Dutch State Railways; tractive effort 30,865 lb.

BRITISH TYPES, 1921. Locomotives in 1921. Engineer, vol. 133, no. 3445, Jan. 6, 1922, pp. 10-12, 17 figs. partly on supp. plates and p. 14. Data on locomotives built for different British roads.

ELECTRIC. *See Electric Locomotives.*

FREIGHT. Geared Locomotive for Freight Service. Ry. Jl., vol. 28, no. 2, Feb. 1922, p. 12, 1 fig. Particulars of 150-ton Shay geared three-truck type locomotive for freight service in mountainous regions. Tractive power, 59,740 lb. Built by Lima Locomotive Works, Inc., for Greenbriar, Cheat & Elk Railroad.

GASOLINE. A Practical and Powerful Gasoline Switch Locomotive, J. C. Josephs, Jr., Ry. Rev., vol. 70, no. 3, Jan. 21, 1922. pp. 82-84, 4 figs. Describes the Mack gasoline locomotive by which smoke and fire risks are eliminated.

REBUILT. Rebuilt Locomotives, London & South Western Railway. Ry. Gaz., vol. 36, no. 1, Jan. 6, 1922, pp. 21-23, 6 figs. By rebuilding, tractive effort is raised from 21,620 to 23,500 lb. for freight engines, and from 16,900 to 20,240 lb. for tank engines.

STOKERS. An Everyday Run With the New Hanna Type H-2 Stoker. Ry. Rev., vol. 70. no. 2, Jan. 11, 1922, pp. 51-53, 2 figs. Describes performance on Norfolk & Western mountain-type locomotive.; tractive effort, 57, 200 lb.

THREE-CYLINDER. Three-Cylinder Locomotive for Spanish Railways. Engineer, vol. 133, no. 3449, Feb. 3, 1922, pp. 134-136, 8 figs. partly on supp. plate. Describes 8-coupled locomotive of 4-8-0 type, with double bogie tender, built by Yorkshire Engine Co., Ltd., Sheffield, England. Gives characteristics of engine and tender.

TRUCK ARRANGEMENT. On the Question of Bogies (Trucks), Axles and Springs of Locomotives, M. Bochet. Int. Ry. Assn. Bul., vol. 4, no. 1, Jan. 1922, pp. 193-250, 20 figs. Report No. 2 (All countries, except those using English language, Belgium and Scandinavian countries). Best arrangement of truck, axles and springs of locomotive for high speeds, with long wheelbases, so as to facilitate running round curves and to insure proper stability of engines.

LUBRICATING OILS

TREATMENT OF DISTILLATES. The Treatment of Refined Oil Distillate, C. D. Dean. Can. Machy., vol. 27, no. 5, Feb. 2, 1922, pp. 42-44 and 46. Removing wax by cooling; treating lubricating oils; pitches and paving asphalts; distillation under pressure; storage; etc.

LUBRICATION

VISCOSITY. Lubrication and Lubricants, Leonard Archbutt. Soc. Chem. Industry Jl., vol. 40, no. 24, Dec. 31, 1921, pp. 287T-293T. Discusses theory of viscous lubrication; measurement and expression of viscosity; effect of pressure on viscosity and density; solid contact friction; oilines and its measurement; thickness of lubricating films; solid lubricants.

M

MACHINE GUNS

PATENTS FOR INVENTIONS. Ordnance and Machine Guns. Abridgments of Specifications, Period—A.D. 1909-15, class 92 (ii), 1921, 355 pp. Patents for inventions.

MACHINE SHOPS

BRITISH. Famous British Works. Eng. Production, vol. 4, nos. 67 and 69, Jan. 12 and 26, 1922, pp. 26-28, 5 figs., and 74-76, 6 figs. Jan. 12: Describes works of Fielding & Platt, Ltd., Gloucester, for manufacture of hydraulic machinery and gas and oil engines. Jan. 26: Works of Geo. Richards & Co., Ltd., near Manchester.

DEPARTMENT LAYOUT. Department Layout in the Colburn Shop, Fred H. Colvin. Am. Mach., vol. 56, No. 7, Feb. 16, 1922, pp. 259-261, 12 figs. Arrangements for machining, erecting and testing units and compete machines. Toolroom arrangement and heat-treating department. Lavatory and coatroom.

MAGNESIUM ALLOYS

ELECTRON METAL. Elektron Metal, Adolph Bregman, Metal Industry (N.Y.), vol. 20, no. 1, Jan. 1922, pp. 1-5, 9 figs. Discusses composition; physical, chemical and electrical characteristics; fabrication, working, soldering and welding; melting and casting; principal uses; advantages and disadvantages.

MAPPING

AERIAL PHOTOGRAPHY IN. Uses of Aerial Photographs in Map Making, Glenn S. [illegible], vol. 88, no. 5, Feb. 2, 1922, pp. 194-196, 2 figs. [illegible] made within past year by Topographic Branch of U.S. Geol. Survey have proved beyond doubt that this source of information will be extensively used in connection with topographic mapping of [illegible]

MARINE BOILERS

[illegible] Coal Economy at Sea by Improved Methods of Steam [illegible], vol. 26, no. 137, 1922 (New Year Number), pp. 49-54, 5 figs. Performance of stationary and marine boiler plants; coal weighing; boiler feedwater meters; saving effected by continuous [illegible]

MECHANICS

MODERN THEORIES. Modern Theories in Mechanics (Les théories modernes de la mécanique), F. Blondel. Revue de l'Industrie Minérale, no. 25, Jan. 1, 1922 pp. 1-21, 12 figs. Discusses Einstein's theory of relativity and experiments leadimg up to it.

RIGID FRAMES, CALCULATION OF. Simplified Calculation of Rigid Frames, H. Marx. Mech. Eng., vol. 44, no. 2, Feb. 1922, p. 125, 1 fig. Describes new process devised by H. Bronneck for calculating most complicated frame shapes directly and without use of tables. Translated from Dinglers Polytechnisches Jl., vol. 336, no. 21, Oct. 22, 1921, pp. 301-302, 2 figs.

METALS

CLEANING. Industrial Methods of Metal Cleaning, F. MacDonald. Forging & Heat Treating, vol. 8, no. 1, Jan. 1922, pp. 66-70, 6 figs. Cleaning material; equipment for cleaning metal parts; methods.

COLLOIDAL STATE. Colloidal State in Metals and Alloys—III and IV, Jerome Alexander. Chem. & Met. Eng., vol. 26, nos. 4 and 5, Jan. 25, and Feb. 1, 1922, pp. 170-172 and 201-207, 11 figs. Jan. 25: White metals and brass. Feb. 1: Iron and Steel. Paper read before Am. Inst. Min. & Met. Engrs.

ELECTRODEPOSITION. Electrodeposition of Metals. Faraday Soc. Trans., vol. 16, part 3, July 1921, pp. 473-513, 12 figs. Includes following papers with discussions: Electroplating for the Prevention of Corrosion, Leslie Aitchison. Some Applications of Electrodeposition in Aeronautical Engineering, W. A. Thain. Electrodeposition of Cobalt, Byron Carr. Commercial Electrolysis of zinc Sulphate Solutions, Samuel Field. Deposition of Gold-Silver Alloys, Samuel Field.

FAILURE UNDER STRESS. Chemical Influences in the Failure of Metals under Stress, Cecil H. Desch. Faraday Soc. Trans., vol. 17, part 1, no. 49, Dec. 1921, pp. 17-21. Investigation of such instances of intercrystalline rupture as may be attributed to action of chemical reagents.

The Mechanism of Failure of Metals from Internal Stress, W. H. Hatfield. Faraday Soc. Trans., vol. 17, part 1, no. 49, Dec. 1921, pp. 36-46, 7 figs. Discusses influence of cold work, and chemical and corrosive attack. Notes on relative properties of amorphous and crystalline phases of metals, dealing with physical properties (hardness, elasticity, and capacity for plastic deformation) and chemical properties.

FATIGUE FAILURE. Remarks on Fatigue Failure of Metal Parts, their Cause and Prevention, Horace C. Knerr. Forging & Heat Treating, vol. 8, no. 1, Jan. 1922, pp. 40-42, 4 figs. Factors upon which fatigue failure degends are: Number of repetitions; range of stress; presence of points at which stress may be localized. Gives example of fatigue failure.

HARDENING. The Slip Interference Theory of the Hardening of Metals, Zay Jefferies and R. S. Archer. Chem. & Met. Eng., vol. 26, no. 6, Feb. 8, 1922, pp. 249-252. General reply to questions raised by various commentators, including condition of iron and carbon in and grain size of martensite.

INTERNAL STRESSES. Internal Stresses in Relation to Microstructure, J. C. W. Humfrey. Faraday Soc. Trans. vol. 17, part 1, no. 49, Dec. 1921, pp. 47-51, 3 figs. Author offers suggestions, and draws attention to factor in strength of materials which does not appear adequately to have been studied.

POLISHING. Motion Study in Metal Polishing. Metal Industry (Lond.), vol. 20, no. 2, Jan. 13, 1922, pp. 30-33, 3 figs. Describes experiment with a wattmeter on the process of roughing.

SEASON CRACKING. The Failure of Metals under Internal and Prolonged Stress, W. Rosenhaim. Faraday Soc. Trans., vol. 17, part 1, no. 49, Dec. 1921, pp. 2-16, 2 figs. Discussion of phenomenon known a sseason cracking, and consideration of the various explanations therefor.

MINING INDUSTRY

ANALYSIS 1921. Industrial Analysis for 1921. Eng. & Min. Jl., vol. 113, no. 3, Jan. 21, 1922, pp. 81-97. Review of copper, lead, zinc, gold, silver, platinum, quicksilver, iron-ore, manganese, chromite, nickel, tungsten, molybdenum, vanadium, uranium and radium mining, petroleum outlook, fluorspar, borax, graphite, magnesite and other industries.

MOLDING MACHINES

AIR AND ELECTRIC. Develops Air and Electric Machine. Foundry, vol. 50, no. 2, Jan. 15, 1922, pp. 75-76, 1 fig. Air used for ramming sand into molds; but electricity has been adapted for rolling flask and afterwards drawing pattern.

DESIGN. The Present Status of Molding-Machine Construction (Der heutige Stand des Formmaschinenbaues,) U. Lohse. Zeit des Vereines deutscher Ingenieure vol. 66, no. 1, Jan. 7, 1922, pp. 4-7, 12 figs. Deals with power molding machines including molding press and hydraulic molding machines.

EQUIPMENT AND USE. Molding Machine Practice Is Successful, Paul R. Ramp. Iron Age, vol. 109, nos. 6 and 7, Feb. 9 and 16, 1922, pp. 397-399 and 462-464, 13 figs. Points out that even without castings recurring in large numbers, method may be made to pay. Details of equipment and its use. Marked gain in efficiency in making cylinder and piston molds.

IMPROVEMENTS. Recent Progress in Machine Molding (Neuere Fortschritte in der Maschinenformerei), U. Lohse. Giesserei-Zeitung, vol. 19, nos. 1 and 2, Jan 3 and 10, 1922, pp. 8-12 and 29-32, 9 figs. Describes new arrangements and methods which tend to increase economy of machines molding.

MOLDING METHODS

GRAY-IRON CASTINGS. Mold Intricate Gray-Iron Castings, H. E. Diller. Foundry vol. 50, no. 2, Jan. 15, 1922, pp. 45-51, 11 figs. Describes methods used for molding gas-meter castings and automobile parts, such as flywheels, transmission housings and piston rings.

MOTOR BUSES

DESIGN. Motor Bus and Its [illegible] Ry. Jl. Bus Transportation Section [illegible] Discusses design of motor buses [illegible] comfort to passengers [illegible]
Some Factors Which [illegible] W. Clark. [illegible] Ry. Jl. Bus [illegible] pp. 14-16, 4 figs. Discusses [illegible] comfort and efficiency [illegible]

DEVELOPMENT. Evolution of the Motor Vehicle for Goods and Passenger Service. Percy Frost Smith. Inst. of Transport Jl., vol. 3, no. 1, Nov. 1921, pp. 35-44 and (discussion) pp. 44-57. History of development, and discussion of four [illegible] transmission vehicles.

DOUBLE-DECK. Details of Equipment and Cost of Operation of Double Deck Buses in Chicago. Elec. Ry. Jl. (Bus Transportation Section), vol. 59, no. 2, Jan. 14, 1922, pp. 31-36, 11 figs. Describes bus of Chicago Motor Bus Co.; seating capacity, 60; inclosed upper deck.

OVERHAULING DEPOT. An Omnibus Overhauling Depot. Engineer, vol. 133, no. 3449, Feb. 3, 1922, pp. 121-124, 19 figs. partly on pp. 130 and 137. Details of large works recently erected by London Gen. Omnibus Co., Ltd., with object of concentrating work of overhauling its vast fleet of motor buses in one building. At least 15 omnibuses are pulled to pieces and re-erected daily. See also Engineering, vol. 113, no. 2927, Feb. 3, 1922, pp. 145-147, 5 figs. partly on p. 140.

MOTORSHIPS

SINGLE AND TWIN-SCREW. Comparison Between Single and Twin-Screw Motor Ships. Shipbldg. & Shipg. Rec., vol. 18, nos. 19 and 20, Nov. 10 and 17, 1921, pp. 607-609 and 639-641, 4 figs. Nov. 19: Discusses heavy and light oil fuel; reliability; ratio of cylinder diameter and stroke. Gives table of performances of a number of Diesel-engined ships. Nov. 20: Propeller efficiency; trial results; new thrust block; cargo space; etc.

PROGRESS 1921. Motor Ships in 1921. Engineer, vol. 133, no. 3445, Jan. 6, 1922, pp. 6-8, 12 figs. partly on supp. plates. Progress in construction of motorships and marine-oil engines in Great Britain, America, Scandinavia, Holland, France, Belgium, Switzerland, Italy and Germany.

MOTOR TRUCKS

BUYING PARTS. Buying Parts for a Big Fleet - How a Big Company Economizes. Commercial Vehicle, vol. 26, no. 1, Feb. 1, 1922, pp. 8-9, 3 figs. Describes organization of Consumers Co. of Chicago, which has recently aquired ecquipment of Cook County Supply Co. and its ten subsidiary organizations.

PARTS DESIGN. Features of Recent Development in Truck Parts Design, P. M. Heldt. Automotive Industries, vol. 46, no. 1, Jan. 5, 1922, pp. 12-18, 12 figs. Discusses recent developments in engine, clutch, transmission, universal joint, rear axle and wheel design.

N

NICKEL STEEL

LOW-CARBON AND CHROMIUM. Low-Carbon Nickel and Nickel-Chromium Steels. Iron & Coal Trades Rev., vol. 104, no. 2812, Jan. 20, 1922, p. 77. Summaries of paper on the constitution and properties of low-carbon nickel steels, by J. N. Greenwood, and paper on nickel-chromium steels, by J. S. Dickenson.

O

OFFICE MANAGEMENT

CUTTING CLERICAL COST. Cutting the Clerical Cost, Henry Anson Piper. Indus. Management, vol. 63, no. 2, Feb. 1922, pp. 119-124, 7 figs. Planning procedure for plant offices in large organizations.

OIL ENGINES

SOLID-INJECTION. The Solid Injection Oil Engine, C. McTaminey. Mar. Eng. of Can vol. 12, no. 1, Jan. 1922, pp. 11-14. Describes experiments made on oil tank of the Trefoil, main engines of which are of the four-stroke cross-head type.

OIL PUMPS

QUIMBY SCREW. The Quimby Screw Pump. Shipbldg. & Shipg. Rec., vol. 19, no. 3, Jan. 19, 1922, p 73. Data on this pump which has been employed in the American naval service as a high-pressure fuel-oil service pump.

OIL SHALES

DEPOSITS. Oil Shale—A. Potential World Wide Industry, Victor G. Alderson. Min. Congress Jl., vol. 7, no. 10, Oct. 1921, pp. 406-409. Review of World's deposits.

OPEN-HEARTH FURNACES

GUN-STEEL MANUFACTURE. Acid Open-hearth Process for Manufacture of Gun Steels and Fine Steels, W. P. Barba and Henry M. Howe. Am. Inst. Min. & Metallurgical Engrs. Trans., no. 1114-S. 1922, 39 pp., 8 figs., and (in abstract) Min. & Metallurgy, no. 181, Jan.1922, pp. 32-34. Report of committee appointed during war by Engineering Division of Nat. Research Council to study steel melting and ingot production for guidance of wartime manufacturers. Precautions are given for making the ingots of proper and uniform composition; of proper macro- and micro-structure; sound, that is, free from pipes, blowholes, cracks and roughness; and to prolong life of furnace.

OSCILLOSCOPE

OPERATION. The Oscilloscope Motor Transport, vol. 34, no. 883, Jan. 30, 1922, pp. 123-124, 3 figs. Describes invention by means of which it is possible to examine any fast-running machinery either as is it were running at 11100 of its actual speed, or, at will, as if it were stationary.

OXY-ACETYLENE WELDING

PIPE. Autogenous Pipe Welding, H. B. Iglehart, Power, vol. 55, no. 5, Jan. 31, 1922, pp. 173-174, 4 figs. Account of practical demonstrations of welded pip joints made under direction of writer at W. K. Mitchell Co. shops. (A tract.) Paper read before Int. Acetylene Assn.

RODS FOR. Welding Rods for Oxy-Acetylene Welding, J. R. Dawson. Iron Age, vol. 109, no. 7, Feb. 16, 1922, pp. 468-472, 17 figs. Also Welding Engr., (vol. 7, no. 1, Jan. 1922, pp. 32, 37 and 40, 17 figs.) under title: Oxy-Acetylene Welding Rods. Their selection and composition as factor in successful results on steel. Welding cast iron. Copper and brass welding. Paper before International Acetylene Assn.

P

PACKING

TRANSIT AND STORAGE. Packing and Wrapping-Up for Transit and Storage (including Baling). Abridgments of Specifications Period—A.D. 1909-15, class 94 (i), 1921, 221 pp. Patents for inventions.

PAPER MANUFACTURE

CHEMICAL HYDRATION OF PULP. Chemical Hydration of Pulp, Alfred MacKay. Paper, vol. 29, no. 16, Dec. 21, 1921, pp. 7-10. Discusses hydration of stock by chemical treatment to replace hydration by beating, and gives results of tests carried out showing advantages of chemical hydration.

PAVEMENTS, ASPHALTS

ASPHALT-CONCRETE, SPECIFICATIONS. Dense Asphalt Concrete Pavement Specifications, J. W. Howard. Mun. & County Eng., vol. 62, no. 1, Jan. 1922, pp. 19-22. Gives apecifications which writer believes to be the best requirements for materials and construction of this type.

MINERAL AGGREGATES SPECIFICATIONS. Standardized Specifications for Mineral Aggregates for Asphalt pavements, Roy M. Green. Eng. & Contracting, vol. 57, no. 5, Feb. 1, 1922, pp. 115-117. Physical properties essential to success of various aggregates in different types of construction. Paper presented before Good Roads Congress.

LAID AND WOVE MOLDS. Laid and Wove, Dard Hunter. Paper, vol. 29, no. 16, Dec. 21, 1921, pp. 12-18, 7 figs. Origin of the terms described and their early use set forth.

PAPER MILLS

CONSTRUCTION. Paper Mill Construction, H. S. Taylor. Paper, vol. 29, no. 15, Dec. 14, 1921, pp. 9-11. Discusses engineering as related to pulp and paper industry, plant development, efficiency in operations, organization, etc.

PEAT

BRIQUETTES FROM. Commercial Briquettes from Peat, Albert L. Stillman. Am. Peat Soc. Jl., vol. 15, no. 1, Jan. 1922, pp. 18-23, 1 fig. Describes universal briquetting press, designed by E. B. A. Zwoyer, consisting of a frame—a single casting comprising base and two double-walled side girders, rolls, drive and feed. Describes shape, and physical and chemical characteristics of briquets turned out by this press.

PETROLEUM

CHEMICAL PRODUCTS FROM. Some New Petroleum Products, J. H. James. Chem. & Met. Eng., vol. 26, no. 5, Feb. 1, 1922, pp. 209-212, 2 figs. Describes work done in an attempt to prepare new chemical products by starting with petroleum as the raw material. Fundamental idea of process involved is vapor-phase, low-temperature, catalytic oxidation of asphaltic hydrocarbons of petroleum. Paper read before Am. Inst. Chem. Engrs.

REFINING. General Practice Adopted in Oil Refining, C. D. Dean. Can. Machy., vol. 27, no. 4, Jan. 26, 1922, pp. 27-29. Selection of refinery site; boiler plant and pumping requirements; details of distillation processes for oils,pitches and asphalts; fire precautions.

PIPE, STEEL

CENTRIFUGALLY CAST. Steel Pipe by the Centrifugal Process, L. Cammen. Iron Age, vol. 109, no. 6, Feb. 9, 1922, pp. 405-406. Methods and cost of Cammen process for making seamless pipe at low cost. Competition with welded pipe.

PIPE, WOOD-STAVE

REDWOOD VS. FIR. Wood-Stave Water Pipe. Pub. Works, vol. 52, no. 1, Jan. 7, 1922, p. 5, Summary of results obtained by its use in U.S. Reclamation projects during past 20 years. Comparison of fir and redwood, buried and above ground.

60-IN. PIPE LINE. 60-Inch Wood Stave Pipe Line for Hydroelectric Plant, W. A. Scott. Eng. World, vol. 20, no. 2, Feb. 1922, pp. 69-70, 2 figs. New Pipe line, 912 ft. long, was built upon a regraded bed and is supported by 166 concrete cradles, each 6 in. thick above ground, with concrete bases 12 in. thick. Staves were creosoted by vacuum process.

POLES

STIFFNESS. The Stiffness of Poles for Overhead Transmission Lines, Gower B. R. [illegible] vol. 90, no. 2302, Jan. 6, 1922, pp. 9-10, 1 fig. Discusses longitudinal forces of line, including bending and torsional forces [illegible] pressure of wind, inequality of thermal expansion in adjoining spans of unequal length.

POWER FACTOR

[illegible] Saving Money by Improving the Power Factor, Elmer S. Small. Indus. Management, vol. 63, no. 2, Feb. 1922, pp. 107-110, 6 figs. Discusses features of electrical power savings that are usually understandable only by electrical engineers.

POWER PLANTS

REMODELING. Remodeled Naval Proving Grounds Power Plant, P. J. Searles. Power vol. 55, no. 4, Jan. 24, 1922, pp. 133-134, 2 figs. Describes changes that were made, and gives total cost figures for new boiler, stoker, generator, electrical and auxiliary equipment, etc. Plant was kept in operation while work of remodeling was going on. Explains how difficulty arising in supporting steam pipes was overcome.

POWER TRANSMISSION

FRICTION LOSSES. The Problem of Efficient Power Transmission, G. C. V. Hewson. Can. Machy., vol. 27, no. 3, Jan. 19, 1922, pp. 23-26, 8 figs. Friction causes largest percentage of loss; charts and tables showing different conditions.

INDUSTRIAL PLANTS. Power Transmission in Industrial Plants, Kenneth M. Raynor. Assn. Iron & Steel Elec. Engrs., vol. 4, no. 1, Jan. 1922, pp. 1-10 and (discussion) 10-21, 5 figs. Discusses construction, operation and some operating results obtained from a 6600-volt, 25-cycle, three-phase balanced-current overhead power transmission loop system operating in a modern steel-mill plant.

PRECIPITATION

COTTRELL PROCESS. Recent Progress in Electrical Precipitation, Evald Anderson. Chem. & Met. Eng., vol. 26, no. 4, Jan. 25, 1922, pp. 151-153. Describes electrical field existing in a Cottrell 'precipitator; essentials of electric precipitation; back ionization; size of electrode and rate of precipitation; etc.

PRESSES

PUNCH, GUARD FOR. Eliminating Cold Trim Press Accidents, G. A. Kuechenmeister. Forging & Heat Treating, vol. 8, no. 1, Jan. 1922, pp. 71-72, 2 figs. After experimenting with various kinds of "two-handed" mechanical tripping devices an electrical guard was installed. Production has not suffered and accidents are eliminated.

PROPELLERS, SHIP

CRITICAL SPEED OF SHAFTS. The Critical Speed of Propeller Shafts, P. E. Brunnelli. Shipbldg. & Shipg. Rec., vol. 19, no. 1, Jan. 5, 1922, pp. 17-18, 1 fig. Develops an empirical formula which within the limits of usual applications gives results very nearly concordant with those obtained by mechanical treatment.

PULVERIZED COAL

EVAPORATIVE TESTS. Pulverized Coal (Le Combustible pulvérisé), Charles Baron. Mémoires et Compte Rendu des Travaux de la Société des Ingénieurs Civils de France, vol. 74 ,nos. 7-8-9, July-Sept. 1921, pp. 403-411, 1 fig. Details of evaporation tests carried out at various plants to show efficiency of powdered coal burning.

PREPARING AND DISTRIBUTING SYSTEM. Preparing and Distributing Powdered Coal. E. C. Greisen. Iron Age, vol. 109, no. 5, Feb. 2, 1922, pp. 326-329, 8 figs. Modern seamless steel-tube plant adopts pulverized coal as fuel. Details of system in use for furnaces and boilers.

PUMPS

BOILER-FEED, GOVERNOR FOR. Thermofeed Differential Feed-Pump Governor. Power, vol. 55, no. 5, Jan. 31, 1922, pp. 184-185, 4 figs. Describes device which, when attached to steam supply of pump, will not only cause pump to stop when any predetermined pressure has been attained, but will start pump again as [illegible] predetermined drop in pressure has taken place in fuel pipe.

PUMPS, CENTRIFUGAL

[illegible] AND LOW-LIFT. The Application of High- and Low-Lift Centrifugal Pumps. Mech. World, vol. 71, nos. 1829 and 1830, Jan. 20 and 27, 1922, pp. 46-48 and 67-68, 9 figs. Jan. 20: Characteristics of a centrifugal pump; advantages of centrifugal over reciprocating type. Describes De Laval single-stage cen- [illegible] capacity of 10,000 gal. per min. against 150 ft. head Jan. 27: Discusses boiler feeding and electrically driven centrifugal boiler-feed [illegible] surface condensers barometric and jet condensers.

PYROMETERS

[illegible] of Pyrometric Systems, R. W. New- [illegible] Forging & Heat Treating, vol. 8, no. 1, Jan. [illegible] of appreciation of sensitivity of pyrometric instru- [illegible] high factor in maintenance cost; better protection [illegible] tion.

[illegible] Instruments for Industrial Measure- [illegible] 1, Jan. 1922, pp. 18-27, 9 figs. [illegible] Discusses temperature [illegible] pyrometers, recording poten- [illegible] appearing filament-type optical [illegible] meter.

Q

QUARRIES

EXPLOSIVES AND BLASTING. Explosives and Blasting, Rock Products, vol. 25, no. 2, Jan. 28, 1922, pp. 44-48. Important relation of explosives to economical operation of stone quarries. Description of high explosives and modern methods of firing. Abstract of two papers by S. R. Russell and N. S. Greensfelder read before Nat. Crushed Stone Assn.

ROCK STRUCTURES, INFLUENCE OF. The Influence of Rock Structures on Quarry Methods, Oliver Bowles Can. Min. Jl., vol. 43, no. 5, Feb. 3, 1922, pp. 63-64. Limestone and slater quarrying; importance of rock study in the economical cutting up of rocks.

R

RADIOTELEGRAPHY

TOWER ERECTION. Antenna Tower Erection For New York Radio Central, David S. Fine. Eng. News-Rec., vol. 88, no. 6, Feb. 9, 1922, pp. 230-234, 9 figs. Floating gin-pole erects body of 410-ft. tower. Method of raising pole. Cross-arms 150-ft. long weighing 16 tons hoisted in two counter-balancing sections. Upper part of tower bolted.

RAILS

BASIC BESSEMER STEEL. Basic Bessemer Steel Rails, Cecil J. Allen. Ry. Engr., vol. 43, no. 504, Jan. 1922, pp. 5-8 and 35, 2 figs. Details of modern methods employed in Europe in production of rails by basic bessemer process, including reaction in basic converter, graphic method of estimating additions, comparison of analysis and test results, reliability of basic bessemer steel.

CORRUGATION. The Corrugation of Tramway Rails. Engineer, vol. 133, no. 3447, Jan. 20, 1922, p. 66, 1 fig. Abstract of report presented to Mun. Tramways Assn. by Rail Corrugation Sub-committee appointed to investigate corrugation of tramway rails with particular reference to vibration of rails and foundations as cause thereof.

GIRDER, ROLLING. Rolling Girder Rails, R. C. Cram. Elec. Ry. Jl., vol. 59, no. 3, Jan. 21, 1922, pp. 102-106, 16 figs. Describes the various rolling-mill processes incidental to rolling girder rails; essential difference in rolling T-rails and girder rails; recent developments.

INTERNAL FRACTURE. The Presence of Internal Fractures in Steel Rails and Their Relation to the Behaviour of the Material under Services Stresses, Henry S. Rawdon. Faraday Soc. Trans., vol. 17, part 1, no. 49, Dec. 1921, pp. 110-116, 7 figs. Discusses discontinuities or internal fractures in some types of steel rails and in other wrought-steel products, evidently serving as "nucleus" or starting point from which larger defects, termed transverse fissures, grow under stress conditions to which rails are subjected in pratice.

JOINT WELDING. Reclaiming Joints in Indianapolis, T. H. David. Elec. Ry. Jl., vol. 59, no. 5, Feb. 4, 1922, pp. 199-201. Discusses experience with Lorain weld joints, arc welding on old tracks, and thermit welding. (Abstract). Paper read before Central Elec. Ry. Assn.

LOADS, ACTION OF. Action of Rolling Loads on Rails (Etude de l'action des charges roulantes sur les rails), S. Timochenko. Le Génie Civil, vol. 79, no. 26, Dec. 24, 1921, pp. 555-556. Assumes the rail as a bar of infinite length on a continuous elastic base, and develops formulas.

MANUFACTURE. Improvement in the Manufacture of Rails. Ry. & Locomotive Eng., vol. 35, no. 1, Jan. 1922, pp. 6-7. Describes tests made with Hadfield sink-head ingots rolled by Maryland Steel Co., showing that after removal of top discard of 13 per cent, the Hadfield ingot is free from piping and undue segregation.

RAILWAY ELECTRIFICATION

ST. GOTHARD RY., SWITZERLAND. The Electrification of the St. Gothard Railway. Engineer, vol. 133, no. 3447, Jan. 20, 1922, pp. 68-70, 15 figs. partly on p. 72. Details of electrical equipment of Ritom and Amsteg power stations, locomotive types, etc.

RAILWAY MOTOR CARS

NEW HAVEN BRANCH LINES. New Haven Using Motor Cars on Branch Lines. Ry. Age, vol. 72, no. 5, Feb. 4, 1922, pp. 315-317, 4 figs. Advantages of new passenger-equipment car, including flexibility and low operating cost.

RAILWAY OPERATION

AVOIDABLE WASTE. Avoidable Waste in Car and Locomotive Operation, William Elmer. Mech. Engr., vol. 44, no. 2, Feb. 1922, pp. 93-97, 2 figs. Outlines procedure for determining whether engines are properly loaded and used. Includes several appendices, one of which gives method of working out most economical tonnage for loading freight engines of any division, based on actual practicable performance in everyday operation. Discusses avoidable waste in operation of cars under three heads: (1) Their utilization in hands of agents, shippers and consignees: (2) handling and dispatchment in yards and on road; and (3) repair and inspection.

BRITISH RAILWAY SPEEDS. Tables of British Railway Speeds in 1921. Engineer, vol. 133, no. 3449, Feb. 3, 1922, pp. 120-121. Annual statistics.

TRAIN CONTROL. The Control of Trains. Ry. Gaz., vol. 36, no. 3, Jan. 20, 1922, pp. 91-92, 1 fig. Discusses the problem of deceleration and considers brake power in relation to increased weight and speed of trains, combined with reduced headway. Summary of paper read before Instn. Civil Engrs.

RAILWAY REPAIR SHOPS

Freight-Car. Community Hospitals for Disabled Foreign Freight Cars, I. J. Tatum. Ry. Rev. vol. 70, no. 3, Jan 21, 1922, pp. 73-76, 2 figs. Advocates adequate car facilities at important interchange points on co-operative basis.

RAILWAY SHOPS

Electric Drive for. Electric Drives in Railroad Shops, Bertram S. Perry. Machy. (N.Y.), vol. 28, no. 6, Feb. 1922, pp. 477-481, 10 figs. Selection and types of motors, and application on different kinds of machine tools.

RAILWAY SIGNALING

Interlocking. Interlocking Practice of the Interborough Rapid Transit Ry., W. A. Bartley. Ry. Rev., vol. 70, no. 4, Jan. 28, 1922, pp. 113-115. Describes electropneumatic power interlocking plant and their equipment; traffic density and control, etc. From paper read before N.Y. Sectional Committee.

Light. The Light Signal Committee's Report. Ry. Gaz., vol. 36, no. 3, Jan. 20, 1922, pp. 80-81. Discusses report of departmental committee to Ministry of Transport, who have been inquiring into the potentialities of light signals. Committee favors color light as against position light.

Track Circuits. Testing of D. C. Track Circuits to Insure Safety and Efficiency, F. B. Weigel. Ry. Signal Engr., vol. 15, no. 1, Jan. 1922, pp. 7-9, 2 figs. Discusses limiting resistance at battery; bonding wires; track ballast; track relay and housing. Simple tests should be made periodically. Paper read before A.R.A.

RAILWAY STATIONS

Freight. On the Question of Goods (Freight) Stations, Edilio Ehrenfreund. Int. Ry. Assn. Bul., vol. 4, no. 1, Jan. 1922, pp. 5-24, 11 figs. Report No. 2 (Italy). Organization of receiving and delivering stations, so as to accelerate their business. Arrangement of building and tracks so as to simplify shunting (switching) operations and handling. Mechanical appliances.

On the Question of Good (Freight) Stations, M. Julien and M. Moutier. Int Ry. Assn. Bul., vol. 4 no. 1, Jan. 1922, pp. 151-192, 12 figs. Report No. 1 (All countries except Italy and those using English language.) Organization of receiving and delivering stations, so as to accelerate their business. Arrangement of buildings and tracks so as to simplify shunting (switching) operations and handling, particularly as regards goods in bulk. Mechanical appliances.

RAILWAY TIES

Specifications. Procurement of Railway Ties Under Federal Control, G. C. Yeomans. Ry. Rev., vol. 70, nos. 1, and 2, Jan. 7 and 14, 1922, pp. 20-22 and 55-57. Work of the Forest Products Section. Standard tie specification most notable achievement. Describes control and distribution of all wood preservatives, together with work involved in procurement of lumber required for construction of Railroad Administration freight cars.

Treatment. Wood Preservers Discuss Economies of Ties. Ry. Age, vol. 72, no. 4, Jan. 28, 1922, pp. 269-271, 1 fig. Factors affecting cost of treated cross ties. Economics of tie renewals. Paper read before Am. Wood-Preservers' Assn.

RAILWAY TRACK

Ballast. Report of Committee II—On Ballast. Am. Ry. Eng. Assn. Bul., vol. 23, no. 239, Sept. 1921, pp. 131-158, 6 figs. Application of ballast; ballast tools; specifications for ballast shovels.

Maintenance. On the Question of the Maintenance and Supervision of the Track, Joseph Barbieri. Int. Ry. Assn. Bul., vol. 4, no. 1, Jan. 1922, pp. 139-150. Report No. 4. (All countries, except Great Britain and America). Measures to be taken to provide an economic organization for maintenance and supervision of track, taking into consideration increase of traffic and speed as well as rise in wages and in cost of materials. Use of mechanical appliances.

Relocation. Costly Railroad Re-location. Cement & Eng. News, vol. 34, no. 2, Feb. 1922, pp. 23-24, 2 figs. Shifting 15 miles of double-track railroad around Huffman dam, Miami Conservancy District, required excavating 657,000 yd., mostly rock in one cut 120 ft. deep, placing 390,000 yd. embankment. Cost more than $3,237,000.

Relocation on the South African Government Railways. Eng. News-Rec., vol. 88, no. 3, Jan. 19, 1922, pp. 116-118, 4 figs. A 70-mi. relocation in rough country, reducing curvature 50 per cent and maximum grades from 3.3 to 1.5 per cent, is being carried out on S. A. Government Railways to meet requirements of increasing traffic.

Roadbed Construction. On the question of the Construction of the Road Bed and of the Track, M. Henry and M. Chandelier. Int. Ry. Assn. Bul., vol. 4, no. 1, Jan. 1922, pp. 251-270, 11 figs. Supp. to Report No. 2 (Oct. 1920, p. 639) (All countries, except Denmark, Sweden, Norway, Great Britain and America.) Arrangements to be adopted, in view of increase in weight of locomotives and speed of trains.

RAILWAY YARDS

Terminals and. Report of Committee XIV—On Yard and Terminals. Am. Ry. Eng. Assn. Bul., vol. 23, no. 239, Sept. 1921, pp. 65-84. Warehouses in connection with L. C. L. freight houses. Classification yards, including methods of switching from classification to departure yards.

RAILWAYS

Light. Development of Light Railways in Great Britain. Eng. News-Rec., vol. 88, no. 5, Feb. 2, 1922, p. 205. Standard gage preferable; or 30-in. for isolated lines. Light rail and load; economic operation; road motors.

Net Cost of Transportation. On the Question of the Net Cost, Rates, Samuel O. Dunn. Int. Ry. Assn. Bul., vol. 4, no. 1, Jan. 1922, pp. 123-138. Report No. 3 (America). Determination of net cost of carriage (passengers and goods), taking capital charges into consideration. Its relation to rates charged.

RECLAMATION

Oregon. 8400 Acres of Overflow Land Reclaimed Near Portland, Ore., George E. Edwards. Eng. World, vol. 20, no. 2, Feb. 1922, pp. 75-76, 4 figs. Describes improvements for Drainage District no. 1, including building of dam and dikes, digging of drainage channels, and installation of pumping plant which is described in detail.

RECTIFIERS

Mercury-Arc. Power Rectifiers, J. H. Milliken. Assn. Iron & Steel Elec. Engrs., vol. 3, no. 12, Dec. 1921, pp. 523-535 and (discussion) 535-554, 4 figs. Discusses the mercury arc rectifier, its advantages and application to large power units.

REFRACTORIES

Thermal Conductivity. On the Determination of the Thermal Conductivity, Specific Heat, Density and Thermal Expansion of Different Rocks and Refractory Materials. Yoshiaki Tadokoro. Tôhoku Imperial University Sci. Reports, vol. 10, no. 5, Dec. 1921, pp. 339-410, 42 figs, partly on supp. plates. Account of investigation begun four years ago in research laboratory of Imperial Steel Works, Yawata.

REFRIGERATING MACHINES

Modern Types. The Present Status of Design of Refrigerating Machines (Der Heutige Stand des Kältemaschinenbaues), Martin Krause. Zeit. des Vereines deutscher Ingenieure, vol. 65, no. 52, Dec. 24, 1921, pp. 1349-1355, 25 figs. Notes on working process of superheated compressor in ammonia machines. Present design of compressors and condensers. Improvement of carbonic-acid machines using hot cooling water by increasing liquid pressure. Steam refrigerating machines for low brine temperatures and high refrigerating capacities.

REFRIGERATING PLANTS

Ammonia Condensers. Types and Constructions of Ammonia Condensers. Power, vol. 55, no. 6, Feb. 7, 1922, pp. 208-210, 7 figs. Discusses principles of operation of several condensers in general use.

Economy in. Refrigerating Plant Economy Standards and Records, Victor M. Azbe. Ice & Refrigeration, vol. 62, no. 1, Jan. 1922, pp. 19-21. Discusses basic requirements of an efficient plant, including, lowest possible condenser pressure and highest possible back pressure, highest possible CO_2 and lowest possible flue-gas temperature, etc. Paper read before Nat. Assn. Practical Refrig. Engrs.

REFRIGERATION

Carbonic-Dioxide Refrigerating Cycle. The Carbonic Refrigerating Cycle, H. J. Macintire. Power, vol. 55, no. 5, Jan. 31, 1922, pp. 175-177, 2 figs. Presents latest table on properties of saturated carbon dioxide, which is said to be great inprovement over previous tables, and diagram known as total-heat diagram, showing effect of condensation or liquefaction of carbon dioxide and condition of substance.

Forecooling Liquid Ammonia. Forecooling of Liquid Ammonia, H. T. Whyte. Ice & Refrigeration, vol. 62, no. 1, Jan. 1922, p. 15. Discusses different methods. Paper read before Nat. Assn. Practical Refrig. Engrs.

Wet vs. Dry Compression. Wet vs. Dry Compression, Van. R. H. Greene. Ice & Refrigeration, vol. 62, no. 1, Jan. 1922, pp. 10-11. Objection to wet compression maximum output for minimum of power; etc. Paper read before Nat. Assn. Practical Refrig. Engrs.

RESEARCH

Mechanical Engineering Advisory Committee. Mechanical Engineering Advisory Committee for Division of Engineering, Alfred D. Flinn. Mech. Eng., vol. 44, no. 2, Feb. 1922, pp. 115-116. Describes contemplated program of committee formed within organization of Am. Soc. of Mech. Engrs.

Problems. Research Problems Discussed. Mech. Eng., vol. 44, no. 2, Feb. 1922, pp. 117-118. Discussion of papers by F. A. Wardenburg and A. D. Flinn. Report of A.S.M.E., work in lubrication, by Albert Kingsbury. Progress in steam-table research described.

RETAINING WALLS

Sand Pressure. Measured Retaining-Wall Pressure From Sand and Surcharge, Jacob Feld. Eng. News-Rec., vol. 88, no. 3, Jan. 19, 1922, pp. 106-108, 1 fig. Results of experiments conducted at University of Cincinnati on effect of settling static and dynamic surcharge, show adaptability of earth-pressure test bin described in previous issue of this journal (Aug. 25, p. 314, 1921).

RIVETING

High-Speed Hammers. Cutting Costs with Rivetting Hammers, Fred R. Daniels. Machy. (N.Y.), vol 28, no. 6, Feb. 1922, pp. 474-476, 6 figs. Several examples of cold heading and rivet-setting operations performed on high-speed riveting hammers made by the High Speed Hammer Co., Inc., Rochester, N.Y., are illustrated.

ROAD CONSTRUCTION

Cost Keeping. Cost Keeping on Highway Construction, A. R. Losh. Eng. & Contracting, vol. 57, no. 5, Feb. 1, 1922, pp. 111-112. Advantages and general principles. Paper read before Good Roads Congress.

Problem. Road Builders' Problems Discussed at Convention. Eng. News-Rec., vol. 88, no. 5, Feb. 2, 1922, pp. 202-204. Abstracts of papers presented at meeting of Am. Road Builders' Assn. as follows: North Carolina's Sub-Grade Roads, Charles M. Upham; Notes on Prick Paving Practice, W. W. Horner: Bituminous Foundations for Street and Road Pavements, High W. Skidmore; Cost Keeping on Highway Construction, A. R. Losh; Problems of Highway Contracting which Affect Costs, Henry H. Wilson; Minnesota's Highway Financing, C. M. Babcock.

ROADS

IMPACT TESTS. The Effect of Impact Forces on Road Pavements, C. A Hogentoglen Automotive Industries, vol. 46, No. 6, Feb. 1922, pp. 277-280, 7 figs. Force of impact blows, as delivered by a road impact machine, can be expressed as an equivalent static road. This offers a means of comparing resistances of paved sections when subjected to impact. Explains method of determination.

ROADS, CONCRETE

DAY-LABOR CONSTRUCTION. Cost Analysis of Day Labor Construction of Wisconsin Concrete Roads, H. J. Kuehling, Concreto, vol. 20, No. 2, Feb. 1922, pp. 81-86, 2 figs. Detailed record of work in five counties, with description of methods producing each cost result.

ROCK DRILLS

DETACHABLE BIT. A Detachable Rock-Drill Bit. Min. & Sci. Press, vol. 123, no. 24, Dec. 10, 1921, p. 806. Describes device perfected by Arthur L. Hawkesworth, consisting of a special double taper by which a bit of vanadium-steel weighing only a few ounces is securely fastened to end of piece of ordinary drill-steel.

ROLLING MILLS

CROSS. Cross-Rolling Mills. Eng. Process, vol. 3, no. 1, Jan 1922, pp. 4-6, 12 figs. Discusses mode of action and field of application, and describes the Friemel cross-rolling mill.

SHEET MILLS. Sheet Mill of the Otis Steel Company. Iron Age, vol. 109, no. 4, Jan. 26, 1922, pp. 259-263, 6 figs. Features include staggered arrangement of furnaces. Powdered coal used. Plant notable for its applications of modern equipment and design.

STRIP-ROLLING CALCULATIONS. Cold Rolled Strip Steel Calculations, S. T. Hilliard. Iron Age, vol. 109, no. 4, Jan. 26, 1922, pp. 267-268. Formulas for determining pounds output and piece-work rates in manufacturing of cold-rolled strip steel.

ROOFS

KNICKERBOCKER THEATER, COLLAPSE OF. Facts of the Knickerbocker Theater Collapse. Eng. News-Rec., vol. 88, no. 6, Feb. 9, 1922, pp. 224-229, 13 figs. Results of examination of ruins of Knickerbocker Theater in Washington. No failure of roof steel preceding fall discovered. Unseating of main truss the first traceable event. Skew bearing on curved wall. Revision of steel design and field changes. Editorial comment, pp. 221-222.

S

SAND, MOULDING

ORIGIN AND USES. Moulding Sands: Their Origin and Uses, Alexander Scott. Mech. World, vol. 71, no. 1830, Jan. 27, 1922, pp. 71-72. Discusses uses of sands as abrasives for casting molds and surface linings, building purposes, an ingredient of soap, and as a filtering medium in connection with water supplies. From paper read before Stoke Assn. of Engrs.

SCALES

PRECISION TESTS. The Precision Test of Large Capacity Scales. Scale Jl., vol. 8, no. 4, Jan. 10, 1922, p. 6, 1 fig. Gives extract from Technologic Paper 199 of Bur. of Standards, which outlines procedure for accurate test.

SCIENTIFIC MANAGEMENT

See Industrial Management.

SEMI-DIESEL ENGINES

PEUGEOT. The Peugeot Semi-Diesel Engine. Motor Transport, vol. 34, no. 882, Jan. 23, 1922, pp. 99-102, 12 figs. Describes two-cylinder two-stroke motor of original design which is being put into service in Paris by General Omnibus Co.

SEMI-STEEL

ELONGATION AND COMPRESSION. Elastic Limits of Elongation and Compression of Semi-Steel (Limites élastiques à la Traction et à la Compression de la Fonte aciérée), M. Portevin, Fonderie Moderne, no. 11, Nov. 1921, pp. 321-324, 5 figs. Gives results of tests from which curves are plotted and formula developed.

SEWAGE DISPOSAL

ACTIVATED SLUDGE. A Preliminary Study of the Activated Sludge Process, John Arthur Wilson, William R. Copeland and Henry Mills Heisig. Jl. Indus. & Eng. Chem., vol. 14, no. 2, Feb. 1922, pp. 128-130, 6 figs. Difficulties in filter-pressing sewage sludge; method of defining condition of sludge; aeration versus septic action. (Abstract.)

Results of Fine Screening and Sludge Dewatering Experiments at Milwaukee. Eng. & Contracting, vol. 57, no. 6, Feb. 8, 1922, pp. 130-132. Account of experiments with activated-sludge process. (Abstract). Report [illegible] Commission of Milwaukee, Wis.

The Design of Aeration Units and Sedimentation Tanks for the Activated Sludge Sewage Disposal Plant at Milwaukee, Wisconsin, Darwin W. Townsend. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 1, Jan. 1922, pp. 43-68, 6 figs. partly on supp. plates. A number of comparatively new terms in sewage-disposal literature, applicable, probably only to this particular process are explained by writer who is entrusted with development of designs for Milwaukee Sewerage [illegible]

[illegible] Maintenance of Clean Filtering Medium in Sewage Filters, Herbert D. Bell. Can. Engrs., vol. 42, no. 3, Jan. 17, 1922, [illegible] for [illegible] sewage filters. They eliminate clogging and ponding; forking not necessary.

IMHOFF TANKS. Sewage Treatment in Imhoff Tanks, Russel Riker. Pub. Works, vol. 52, nos. 3, 4, 5 and 6, Jan. 21, 28 and Feb. 4 and 11, 1922, pp. 39-42, 59-62, 89-91 and 106-107, 10 figs. Notes on separate digestion of sewage sludge in two-story or Imhoff tanks; experiences with 37 such tanks in New Jersey, and conclusions of State Department of Health as to certain advantages and disadvantages of such tanks. Instructions for operating tanks. Foaming in tanks and experiences in trying to control it; chemical analyses of sewage and sludge.

PROGRESS, 1921. Sanitary Engineering in 1921. Engineer, vol. 133, no. 3448, Jan. 27, 1922, pp. 88-90. London main drainage and sewage disposal; power from sewage gas; the Watson experiments; Sheffield experiments in sewage aeration; activated sludge process; Manchester's new outfall sewer; the Aer-sed-con process of treatment; straw filters for sewage purification; the Linden purification processes.

SEWERS

INVERTED SIPHONS FOR. Inverted Siphons for Sewers. Pub. Works, vol. 51, nos. 18 and 19, Oct. 29 and Nov. 5, 1921, pp. 340-341 and 357-358. Presents in condensed form more valuable features of report before Boston Soc. of Civ. Engrs. of committee on inverted siphons for sewers, based on answers to questionnaires.

SHAPERS

VERTICAL. Production Work on Vertical Shapers, Edward K. Hammond. Machy. (N.Y.), vol. 28, no. 6, Feb. 1922, pp. 483-485, 5 figs. Operations advantageously performed on shapers of vertical type.

SHIPS

CARGO. The Economic Proportions of Cargo Ships, H. G. Cleghorn. Shipbldg., & Shipg. Rec., vol. 19, no. 3, Jan. 19, 1922, pp. 81-85, 12 figs. Illustrates method of solving following problem: Given the deadweight, speed, and length of voyage—what is the most suitable length, breadth, and depth? Paper read before Instn. Engrs. & Shipbuilders in Scotland.

SHIPBUILDING

METHODS. Some Notes on Shipbuilding Methods, John McGovern. North-East Cost Instn. Engrs. & Shipbuilders, advance proof, no. 2188-Q, for meeting Fev. 10, 1922, 16 pp., 10 figs. General remarks on present methods; electric welding; riveting and calking by hand or machine; recent improvements in modern shipbuilding plants abroad; mass production methods; comparison of punched versus drilled holes. Modified design of straight frame model with multiple drilling—new system successfully developed by Furness Shipbuilding Co., Ltd., in preparation of hull steel material.

WORLD DEVELOPMENT. The World's Shipbuilding. Engineering, vol. 113, no. 2926, Jan. 27, 1922, pp. 114-115. Contains table showing number and tonnage of merchant vessels of 100 tons gross and upwards launched in various countries of world during years 1892-1921.

SILICA BRICK

BREAKAGE FACTOR IN MANUFACTURE. Breakage Factors in Silica Brick Manufacture, Philip H. Jung. Chem. & Met. Eng., vol. 25, no. 5, Feb. 1, 1922, pp. 214-217. Critical discussion of those factors in manufacture of silica brick which determine breakage records; properties of silica rock; grinding; effect of bats; workmanship; drying; setting in kiln; burning; methods of firing.

SOUTH WALES SILICA. The Refractory Silica Materials of South Wales, W. R. D. Jones. Colliery Guardian, vol. 123, no. 3184, Jan. 6, 1922, p. 41. Discusses importance of texture and correct grading of materials employed in silica brick manufacture; also refractoriness.

SIPHONS

INVERTED. Construction of a Concrete Inverted Siphon. Utah Soc. Engrs. Jl., vol. 7, no. 5, Oct. 1921, pp. 85-95, 8 figs. Describes 50-in., concrete pipe line at Goulam, Idaho, carrying irrigation water across valley 6600 ft. wide. Low point of pipe line is subjected to head of 101 ft. Central plant for mixing and system of trucks to handle freshly poured pipes were used.

SPRINGS

HELICAL, CALCULATION OF. Practical Helical Spring Calculation, Alex Taub. Am. Mach., vol. 56, no. 5, Feb. 2, 1922, pp. 179-183, 2 figs. Essentials of spring design. Analyzing spring troubles mathematically.

STANDARDIZATION

GERMANY. Industrial Standardization in Germany. Mech. Engr., vol. 44, no. 2, Feb. 1922, pp. 136-137. Describes program being carried out in Germany. Organization and methods or work; work in special industries; system of "preferred numbers."

IMPORTANCE. Significance of Standardization, A.A. Stevenson. Am. Mach., vol. 56, no. 4, Jan. 26, 1922, pp. 138-139. Points out need for co-operation between industry and Federal Government. Work of committees in harmonizing conflicting standards and formulating new ones. (Abstract.) Paper presented before Am. Eng. Standards Committee.

STANDARDS

GERMAN N. D. I. REPORT. Report of the German Industry Committee on Standards (Normenausschuss der Deutschen Industrie) Betrieb, vol. 4, no. 6, Dec 24, 1921, pp. 73-77, 4 figs. Proposed standards for fastening of belt pulleys on transmission shafts, and for ball hand cranks. Problems of the working committee for screws.

STEAM

Generation and Utilization. [illegible] Management in Steam Generation and Utilization. David Brownie. Eng. & [illegible] Management, vol. 7, [illegible] 117-120, [illegible] Jan. 26 and [illegible]

STEAM ENGINES

Compound Drop-Valve. Compound Drop-Valve Mill Engine. Mech. World, vol. 71, no. 1827, Jan. 6, 1922, pp. 11-12, 3 figs. Describes cross-compound jet-condensing type of engine, having cylinders 27 in. and 55 in., with a 5-ft. stroke [illegible] Hick, Hargreaves & Co., [illegible] boiler pressure, 160 lb.

Uniflow. 300-H.P. Uniflow Engine. Engineering, vol. 113, no. 2927, Feb. 3, 1922, p. 136, 7 figs. partly on p. 137. Describes engine recently constructed under John Davidson's patents by Clayton, Goodfellow and Co., Ltd., Blackburn, England. It has a single cylinder, [illegible] and operates with steam at 160 lb. per sq. in. and 150 deg. fahr. superheat.

STEAM METERS

Kent-Hodgson. The Kent-Hodgson Steam Meters, J. L. Hodgson. So. African Eng., vol. 32, no. 12, Dec. 31, 1921, pp. 243-245, 5 figs. Describes steam meter developed by the author [illegible] Used in power stations and paper mills, collieries and cement work, due works and pumping stations, on locomotives and on ship board.

STEAM POWER PLANTS

Auxiliary Drives. Driving Power-House Auxiliaries, W. H. Smith. Power, vol. 55, no. 5, Jan. 31, 1922, pp. 166-169, 3 figs. Types of auxiliary drives; Heat-balance considerations that influence selection of drives; a.c. versus d.c. motors suitable voltage for auxiliary motors; selection of motors for various drives.

STEAM TURBINES

Blade Proportioning. The Proportioning of Steam Turbine Blading, Harold Medway Martin. Engineering, vol. 113, nos. 2923, 2924, 2925, 2926 and 2927, Jan. 6, 13, 20, 27 and Feb. 3, 1922, pp. 1-3, 33-34, 66-70, 96-98 and 128-130, 14 figs. Determination of effective thermodynamic head and general dimensions of a compound turbine to operate with given indicated hydraulic efficiency; also relation between thermodynamic head and specific volume.

STEEL

Alloy. *See Alloy Steels*

Boiler-Tube. Occurrence of Oxides and Nitrides in Boiler Tube Steel, A. E. White and J. S. Vanick. Am. Soc. for Steel Treating Trans., vol. 2, no. 4, Jan. 1922, pp. 323-330, 8 figs Discusses examination of boiler tube which has been overoxidized, or allowed to absorb and retain an excess of oxygen and nitrogen.

Castings Ingots. Leaves from a Steel Melter's Note Book, Henry D. Hibbard. Iron Age, vol. 109, no. 7, Feb. 16, 1922, pp. 465-467. Experiences in casting steel ingots in cans. How cracks were prevented. Causes of hard spots in forging ingots.

Chrome. *See Chrome Steel*

Chrome-Nickel. *See Chrome-Nickel Steel*

Cracking. Intercrystalline Cracking of Mild Steel in Salt Solutions, J. A. Jones. Faraday Soc. Trans., vol. 17, part 1, no. 49, Dec. 1921, pp. 102-109, 6 figs. Describes action of various solutions in producing cracking of steel in state of stress

Failure on Hardening. The Mechanism of the Failure of Steel upon and after Hardening, G. W. Green. Faraday Soc. Trans., vol. 17, part 1, no. 49, Dec. 1921, pp. 139-145, 7 figs. Outlines causes of stressing and subsequent failure.

Fatigue Tests. Endurance of Steel Under Repeated Stresses, D. J. McAdam, Jr. Chem. & Met. Eng., vol. 25, no. 24, Dec. 14, 1921, pp. 1081-1087, 22 figs. Fatigue tests on many commercial and alloy steels develop no evidence of "endurance limit"; ultimate tensile strength closely related to endurance stress at 1000,000,000 cycles; special White-Souther machine and semi-logarithmic graphs used.

Fracture. Intercrystalline Fracture in Steel, D. Hanson. Faraday Soc. Trans., vol. 17, part 1, no. 49, Dec. 1921, pp. 91-101, 13 figs. Discusses cases of failure which occur only under certain circumstances, in material of normal quality, when time during which stress is applied is prolonged.

Internal Service Strains. Internal Service Strains in Steel, [illegible] Howard. Faraday Soc. Trans., vol. 17, part 1, no. 49, Dec. 1921, pp. 117-122. Deals particularly with original properties and characteristics of steels, and means by which these original properties are modified.

Literature, 1921. Review of Iron and Steel Literature for 1921, E. H. McClelland. Blast Furnace & Steel Plant, vol. 10, no. 1, Jan. 1922, pp. 4-8. Classified list of the more important books, serials and trade publications during year, with a few of earlier date, not previously announced. Also in Forging and Heat Treating, vol. 8, no. 1, Jan. 1922, pp. 4-8.

Nickel. *See Nickel Steel.*

Nitrogen in. The Determination of Nitrogen in Steel, Frederik Hurum and Henry Fay. Chem. & Met. Eng., vol. 25, no. 5, Feb. 1, 1922, pp. 218-222, 2 figs. Review of literature on the subject. Describes reagents and apparatus recommended for determination of nitride nitrogen.

STEEL, HEAT TREATMENT OF

Cost Analysis. Over-all Cost of Heat-Treated Parts. C. I. Ipsen. Iron Age, vol. 109, no. 7, Feb. 16, 1922, pp. 459-462, 6 figs. Electric current or fuel cost is only a portion of total cost. Percentage of rejection important. Cost of [illegible]

Effect on Properties. The Effect of Heat Treatment on the Properties of Steel, [illegible] Engr., vol. [illegible] Nov. 1, 1921, pp. 69-74 and 109-114, 2 figs. Describes the iron-iron-carbide diagram. Notes on heating and cooling curves, effect of carbon on the change points, effect of heat on grain size, hardening and tempering.

Medium-Carbon Steel. Effect of Time in Reheating Quenched Medium-carbon Steel Below the Critical Range, Carle R. Hayward, Daniel M. MacNeil and Raymond L. Presbrey. Am. Inst. Min. & Metallurgical Engrs. Trans. no. 1111-S, 1922, 5 pp., 2 figs., and (in abstract) Min. & Metallurgy, no. 181, Jan. 1922, pp. 34-35. Results of investigation show that even 5 min. heating at 300 deg. cent. lowers considerably the strength and hardness and increases ductility; there is marked increase in ductility in passing from 400-deg. to 500-deg. treatment without equivalent lowering of strength, specimens reheated to 600 deg. cent. are nearly as ductile as annealed specimens, but have an elastic limit about 60 per cent greater.

Ordnance Purposes. Heat Treatment of Steel for Ordnance Purposes, H. F. Leary. Am. Soc. for Steel Treating Trans., vol. 2, no. 4, Jan. 1922, pp. 288-295. Discusses specification requirements for gun forgings so far as heat treatment is concerned.

STEEL, HIGH-SPEED

American Manufacture. American Practice in High-Speed Steel Manufacture, A. H. d'Arcambal. Chem. & Met. Eng., vol. 25, no. 24, Dec. 14, 1921, pp. 1097-1099, 3 figs. Impressions received on trip of inspection covering several plants. Importance of pure raw materials and metallurgical control of all steps in process is emphasized.

STOKERS

Underfeed, Operation of. The Practical Operation of an Underfeed Stoker. Power, vol. 55, no. 5, Jan. 31, 1922, pp. 179-180, 3 figs. Article, based on actual experience with type AA 4 Taylor stoker, covers following subjects: Starting up; regulating draft and stoker speed; proper thickness and contour of fire; use and misuse of long stroke of lower ram; getting rid of troublesome clinkers; dumping ash; keeping lower ram from binding.

STREET RAILWAYS

Cars, One-Man. One-Man Car Operation with Double-Truck Cars, H. S. Sweet. Elec. Ry. Jl., vol. 59, no. 4, Jan. 28, 1922, pp. 156-158, 9 figs. Describes new one-man car in Utica equipped with turnstiles to admit passengers who pay as they leave. (Abstract) Paper read before N.Y. Elec. Ry. Assn.

Two New Types of Safety Cars for Chicago, Charles Gordon. Elec. Ry. Jl., vol. 59, no. 2, Jan. 14, 1922, pp. 65-71, 14 figs. Describes single-truck and double-truck one-man safety cars, both arranged for double-end operation with separate entrance and exit passageways.

STRESSES

Concentrations Due to Notches. Stress Concentrations Due to Notches and like Discontinuities, E. G. Coker and Paul Heymans. Engineering, vol. 113, no. 2923, Jan. 6, 1922, pp. 26-28, 6 figs. Brief account of experimental investigations made on discontinuities by photoelastic methods described in previous report, whereby stress distributions have been determined sufficiently completely to allow of fairly accurate value being assigned to maximum stresses experienced under given loads. (Abstract.). Report on Complex Stress Distribution, read before British Assn. at Edinburgh.

Thermal. The Thermal Stresses in Spherical Shells Concentrically Heated, Charles H. Lees. Roy. Soc. Proc., vol. 100, no. A 705, Jan. 2, 1922, pp. 379-394, 7 figs. Discusses stresses set up in materials by difference in temperature and its application to blast furnaces and others.

STRUCTURAL STEEL

Joints of Rigid Members. Tests on Joints of Rigid Members (Versuche mit Anschlüssen steifer Stabe), H. Rudeloff. Zeit. des Vereines deutscher Ingenieure, vol. 66, no. 3, Jan. 21, 1922, pp. 68-69, 1 fig. Results of tests conducted at the State Material-Testing Bureau, Berlin-Dahlem, on rigid bars of angle and channel iron. (Abstract.) Berichte des Ausschusses für Versuche im Eisenbau des deutschen Eisenbauverbandes, no. 3.

SUBSTATIONS

Automatic. Automatic Substation Practice at Concord, N.H. Elec. Ry. Jl., vol. 59, no. 5, Feb. 4, 1922, pp. 184-185, 7 figs. Local traction system, serving capital city of granite state, utilizes two installations of labor-saving type with noteworthy reduction in operating expenses at small investment cost.

T

TELEGRAPHY

Printing Systems. Printing Telegraph Systems Applied to Message Traffic Handling A. H. Reiber. Am. Inst. Elec. Engrs. Jl., vol. 41, no. 2, Feb. 1922, pp. 79-91, 26 figs. Discusses economic principles determining applicability of automatic printing telegraph to present-day communication problems, limited to those forms of light-traffic-load printing telegraph systems which have been developed particularly for linking together departments of factory, terminal points of railroad, or branches of large corporations. Detailed description of principle of operation of three such systems.

SUBMARINE-CABLE. Submarine Cable Telegraphy, J. Willard Milnor. Am. Inst. Elec. Engrs. Jl., vol. 41., no. 2, Feb. 1922, pp. 118-136, 32 figs. Describes methods of operation, and various conditions which limit operation. General method of analysis is developed, based on extension of ordinary alternating-current theory.

TELEPHONY

AUTOMATIC. The Development of Automatic Telephony. Engineering, vol. 113, no. 2925, Jan. 20, 1922, pp. 63-66, 9 figs. Brief summary of recent advances in England. Points out main advantage of automatic switching as against manual operating from standpoint of service, administration, accommodation and finance.

An investigation of the Loss Involved in Trunking From Primary Line Switches to First Selectors Via Secondary Line Switches in Strowger Automatic Exchanges, C. McHenry. Post Office Elec. Engrs.' Jl., vol. 14, Part 4, Jan. 1922 pp. 217-227, 1 fig. Discusses plunger and rotary types of line switches, methods of trunk distribution, etc.

TERMINALS, MARINE

CARGO HANDLING. Mechanical Cargo Handling, G. H. Rae. Shipbldg. & Shipg. Rec., vol. 19, no. 1, Jan. 5, 1922, pp. 13-15. Describes experimental cranes at Liverpool docks; portable power units; comparison of crane and man-handling; apparatus for handling barrels; etc. (Abstract). Paper read before Liverpool Eng. Soc.

TEXTILE MACHINERY

MANUFACTURE. Building Textile Machinery Eng. Production, vol. 4, no. 70, Feb. 2, 1922, pp. 109-114, 14 figs. Manufacturing methods and equipment of The British Northrop Loom Co., Ltd., Blackburn.

THERMIT WELDING

JOINING BARS. Joining Bars by Thermit Welding, L. I. Grinnell. Am. Mach., vol. 56, no. 4, Jan. 26, 1922, pp. 132-133, 6 figs. Long bars needed for making lead screws of rifling machines, aligning the sections; making mold and weld.

TIME STUDY

BEDAUX HUMAN POWER MEASUREMENT. The Bedaux Principle of Human Power Measurement, L. C. Morrow. Am. Mach., vol. 56, no. 7, Feb. 16, 1922, pp. 241-245, 2 figs. Describes system practised by Chas. E. Bedaux Co., Cleveland, Ohio. Application to compensation of labor. Isolation from methods, equipment and piece rates. Simplicity of records.

TRANSFORMERS

POWER. Care and Operation of Power Transformers, J. G. Corrin. Assn. Iron & Steel Elec. Engrs., vol. 4, no. 1, Jan. 1922, pp. 23-37 and (discussion) 38-47, 4 figs. Divides power transformers into three classes insofar as methods of cooling are concerned, viz., air blast, O.I.S.C., and O.I.W.C., and discusses their operation.

TEMPERATURE AND MECHANICAL STRESSES. Temperature and Mechanical Stresses in Current Transformers, J. B. Gibbs and L. Dorfmann. Elec. World, vol. 79, no. 5, Feb. 4, 1922, pp. 221-223, 7 figs. Points out that such apparatus should be carefully investigated to ascertain thermal capacity and mechanical strength if it is liable to be subjected to very heavy short-circuit currents.

WATER IN OIL, DETERMINATION OF. Determination of Water in Transformer Oil, J. E. Shrader. Elec. World, vol. 79, no. 4, Jan. 28, 1922, pp. 174-175, 3 figs New method which does not involve usual errors encountered and with which vapor pressure can be determined.

TUBES

BRASS, INTERNAL STRESSES IN. Internal Stresses in Brass Tubes, H. N. Vaudrey and W. E. Ballard. Faraday Soc. Trans., vol. 17, part 1, no. 49, Dec. 1921, pp. 52-57, 7 figs. Deals exclusively with brass tubes of circular section containing about 70 per cent of copper.

ELLIPTIC, THICKNESS OF. Thickness of Elliptic Tubes (Epaisseur d'un tube elliptique) Gay Georges and Gay Albert. Annales de l'Energie, vol. 1, no. 6, Nov.-Dec. 1921, pp. 217-219. Calculat on based on resistance of materials.

U

UNEMPLOYMENT

CAUSES AND REMEDIES. The Unemployment Problem. Nat. Indus. Conference Board, research report no. 43, Nov. 1921, 91 pp. 9 figs. Deals with extent, causes and suggested remedies for unemployment.

INSURANCE SCHEME. Unemployment Insurance With Special Reference to Individual Firms and Industries, Henry Lesser. Jl. Indus. Administration, vol. 1, no. 8, Dec. 1921, pp. 227-239. Discusses a scheme for administration of unemployment insurance in individual firms, with ultimate object of its expansion and application to each organized industry as a separate, self-supporting entity. (Abstract.) Paper read before Inst. Indus. Administration.

V

VALVES

GATE, LOSS OF HEAD IN. Experiments Show Measurements of Valve Loss Dependent on Piezometer Location, Charles I. Corp. Wis. Engr., vol. 26, no. 4, Jan. 1922, pp. 61-62, 4 figs. Describes experiments carried out to determine loss of head due to flow of water.

[illegible] Reflux Valve. Engineering, vol. 113, no. 2923, [illegible] Describes large valves constructed by Glenfield & Kennedy, Ltd., Kilmarnock, England, consisting of a cylinder which, when [illegible] the main, and, when valve is open, [illegible] as to have a large free waterway.

VENTILATION

KATATERMOMETERS. Ventilation and Human Efficiency, Leonard Hill. Mech. [illegible] 1922, p. 69. Better health due to attention to good ventilation, and increase in efficiency and output due to cooling power [illegible] electric and recording katathermometers. From paper read before Instn. Min. & Met.

VOCATIONAL TRAINING

SEASONAL INDUSTRIES. A Management Problem in Seasonal Industries, D. W. Rockey. Indus. Management, vol. 63, no. 2, Feb. 1922, pp. 77-79, 1 fig. Problem of seasonal industries is to efficiently teach large increases of working forces in minimum of time. Solution of problem is training of largest possible corps of instructors, both as to instructional methods and as to operating procedure and organization.

W

WAGES

PIECE-PRICE SYSTEMS. Should Piece-Price Systems Be Abandoned?, James H. Delaney. Factory, vol. 28, no. 2, Feb. 1922, pp. 175-176, 2 figs. Writer tells why he believes that piece-price systems should be scrapped and how scrapping will bring lower wages without cutting piece rates.

WASTE ELIMINATION

RESEARCH AND. Elimination of Waste in Industry Through Research, F. A. Wardenburg. Mech. Eng., vol. 44, no. 2, Feb. 1922, pp. 115-116. Outlines plan of a large corporation. Suggests co-operative plan. (Abstract.)

WASTE HEAT

UTILIZATION. Utilization of waste Heat. Eng. & Indus. Management, vol. 7, no. 4, Jan. 26, 1922, pp. 102-105, 2 figs. Suggests combination of heat distribution with generation of electric current as possible means of using coal to better advantage. Based on paper presented before (British) Instn. Elec. Engrs. by V. Ingham Haden.

WASTES

ENGINEERING INDUSTRIES. Waste in the Engineering Industries. Times Eng. Supp., Jan. 21, 1922, pp. 1-5. Views of representative manufacturers on accidental and deliberate waste, routine waste, waste of business, and deficient use of machinery.

WATER

REACTIONS OF CULTURE MEDIA. The Reactions of Culture Media, George C. Bunker and Henry Schuber. Am. Water Works Assn. Jl., vol. 9, no. 1, Jan. 1922, pp. 63-116, 8 figs. In writers' opinion, reactions of culture media used in water-works laboratories should be adjusted by colorimetric method of determining the H-ion concentration; and that definite H-ion concentrations should be used for reactions of nutrient agar, nutrient gelatine, sugar broths, etc. Bibliography.

WATER GAS

BLUE, PRODUCTION. Blue Water-Gas Production, J. W. Cobb and A. Parker. Gas Jl., vol. 156, no. 3056, Dec. 7, 1921, pp. 681-682. Reply to discussion on sixth report of Gas Investigation Committee of Instn. Gas. Engrs. submitted by authors on behalf of committee.

CONTINUOUS GENERATOR. Continuous Water Gas Producer, A. W. H. Griepe. Am Gas Jl., vol. 116, no. 3, Jan. 21, 1922, pp. 53-54 and 66, 1 fig. Advantages claimed for it over intermittent type of producer. Operating data.

WATER POLLUTION

GAS-PLANT WASTES AND. Effect of Gas Plant on Taste and Odor of Water. Eng & Contracting, vol. 57, no. 6, Feb. 8, 1922, pp. 132-133. Two articles reprinted from Dec. and Jan. issues of Proc. Am. Soc. Civ. Engrs.: Interference with Water Filtration Plant Operation by Wastes from By-Product Coke Ovens and Gas Works, C. A. Emerson. Jr.; and Experiences at Milwaukee, V. M. Baker

WATER SUPPLY

GREAT BRITAIN, 1921. Water Supply in 1921. Engineer, vol. 133, no. 3447 Jan. 20, 1922, pp. 64-66. Review of development in Great Britain, with note on the Littleton reservoir and other works of Metropolitan Water Board de-ironing water; Birkenhead's supply from Lake Alwen; Cardiff's new water works; Scar House hydroelectric plant; compensation water for River Don Manchester's water supply; etc.

PURIFICATION. Water Supply and Water Purification: A Symposium. Am. Soc Civ. Engrs. Proc., vol. 48, no. 1, Jan. 1922, pp. 117-124. Continued from Dec. 1921.

SCREEN FOR INTAKE WELL. Water Intake Protected Against Severe Conditions Eng. News-Rec., vol. 88, no. 6, Feb. 9, 1922, pp. 235-236, 3 figs. Describes largest traveling screen outfit in world. Pivoted crane with grab bucket remove logs and dirt from deep well.

WATERWAYS

ST LAWRENCE RIVER PROJECT. Solving the Problem of St. Lawrence Navigation Chas. P. Loveland. Can. Engr., vol. 42, no. 5, Jan. 31, 1922, pp. 189-19 Shortcomings of schemes so far proposed. Navigation value of side canals questioned. Two-stage development on international section favored.

ST. LAWRENCE. Why the Joint Commission Favors the St. Lawrence Waterway Eng. News-Rec., vol. 88, no. 5, Feb. 2, 1922, pp. 200-201. Summary of conclusions of report discusses navigation possibilities, economies and engineering features.

WELDING

LOCOMOTIVE BOILERS. Locomotive Boiler Welding. Welding Engr., vol. 7, no. Jan. 1922, pp. 26-28, 19 figs. Special committee of Master Boiler Maker Assn. reports best methods of reconditioning boilers. To be presented before Master Boiler Makers' Assn. convention.

WIRE SPECIFICATIONS. Welding Wire Specifications and Folios. Am. Welding Soc Bul. no. 1, Dec. 1921, 16 pp. Report of committee.

See also Electric Welding, Arc: Fusion Welding: Oxy-Acetylene Weld; Thermit Welding.

WELDS

TEST STANDARDS. Committee Recommends Standards for Tests of Welds. Automotive Industries, vol. 46, no. 1, Jan. 5, 1922, pp. 19-20, 6 figs. Describes the shop commercial and research standards of tests which Am. Bur. of Welding committee finds are desirable.

Standards for Testing Welds. Am. Welding Soc., Bul. no. 1, June 192 16 pp. 14 figs. Report of committee.

Engineering Index

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A

ABRASIVES

PROPERTIES AND USES. Grinding Wheels (Les Meules Artificielles), E. Assié. Arts et Métiers, vol. 74, no. 12, Sept. 1921, pp. 265-270, 7 figs. Discusses abrasives, carborundum, corundum, melting points, resistance to acid, use as refractories, etc.

ACCIDENTS

PLACING RESPONSIBILITIES. Placing Responsibility for Accidents, H. L. Keely. Management Eng., vol. 2, no. 3, Mar. 1922, pp. 149-152, 3 figs. Through classifying according to kind and cause and by estimating cost of remedies.

ACCOUNTING

PIG-IRON PRODUCTION. Accounting for Pig-Iron Production, Nathaniel B. Bergman. Jl. of Accountancy, vol. 33, no. 2, Feb. 1922, pp. 90-99. Discusses blast-furnace operations and how to deal with them in accountancy.

AERODYNAMICS

STANDARDIZATION. Standardization in Aerodynamics, W. Margoulis. Aerial Age, vol. 14, no. 26, Mar. 6, 1922, pp. 614-615. Agrees with article of same title by W. Knight, published in Aerial Age, June 20, 1921, as to standardization on basis of experiments of American, British, French and German quasi-official laboratories.

AERONAUTICS

HYDRODYNAMICS, APPLICATION OF. Applications of Modern Hydrodynamics to Aeronautics, L. Prandtl. Nat. Advisory Committee for Aeronautics, Report no. 116, 1921, 61 pp., 62 figs. Discusses the theoretical underlying principles, theory of aerofoils, and application of aerofoil theory to screw propellers.

AIR COMPRESSORS

EXPLOSIONS. Explosions in Air Compressors, A. D. Risteen. Sugar, vol. 24, no. 2, Feb. 1922, pp. 99-100. Deals with presence of lubricating oil and carbon deposits, and suggests that all accumulation of deposits be prevented. From address before Nat. Safety Council.

AIR CONDITIONING

AIR DRYING. The Volume of Air Required in Air Drying, C. T. Mitchell. Chem. & Met. Eng., vol. 25, no. 24, Dec. 14, 1921, pp. 1088-1090, 3 figs. Factors affecting atmospheric evaporation; cooling of air during evaporation, distinction between wet bulb temperature and dew point; calculation of volume of air required, etc. Charts for 100, 85, and 70 per cent ultimate humidity.

AIRCRAFT CONSTRUCTION MATERIALS

WIRE CABLE, ELASTICITY OF. A Study of the Elastic Properties of Small-Size Wire Cable, R. R. Moore. Mech. Eng., vol. 44, no. 2, Feb. 1922, pp. 105-106 and 111. Results of series of tests carried out at McCook Field, Dayton, Ohio, in which it is shown that modulus of elasticity of small-sized wire aircraft cable varies from 15,000,000 to 28,000,000, depending upon size and type of cable. It was also found that modulus of elasticity may be raised by loading cable below elastic limit and that resting the cable does not seem to have any definite effect on modulus.

AIRPLANE ENGINES

AIR-COOLED. Air-Cooled Engine Development, Charles L. Lawrence. Soc. Automotive Engrs. Jl., vol. 10, no. 2, Feb. 1922, pp. 135-141 and 144, 13 figs. Describes British experiments to improve performance of air-cooled engines for aircraft, which lead eventually to development of aluminum cylinders with steel liners and aluminum cylinder heads with steel cylinder screwed into head. Advantages of these and disadvantages of other types.

GASOLINE TESTS. Tests of Aeroplane Motor with Different Gasolines, O. J. May and Howard Cooper. Sci. Lubrication, July 1921, pp. 9-13, 4 figs. Describes tests made to show effect of using different grades of gasoline in aeronautical engine operation.

AIRPLANE PROPELLERS

THRUST AND TORQUE CHARACTERISTICS. Tests on Air Propellers in Yaw, W. F. Durand and E. P. Lesley. Nat. Advisory Committee for Aeronautics Report, no. 113, 1921, 37 pp., 26 figs. Results of tests to determine thrust (pull) and torque characteristics of air propellers in movement relative to air in a line oblique to line of shaft, and specifically when such angle of obliquity is large, as in case of helicopter flight with propeller serving for both sustentation and traction.

AIRPLANES

FLYING BOATS. *See Flying Boats.*

GLIDERS. *See Flight, Soaring.*

HELICOPTERS. *See Helicopters.*

PASSENGER. The Problem of the Passenger Aeroplane, W. D. Beatty. Aeroplane, vol. 22, no. 2, Jan. 11, 1922, pp. 27-28, 1 fig. Deals with comfort of passengers on commercial aircraft. Discusses desirable attributes not yet incorporated in modern machines; military development of airplane; beginning of commercial development; design of detail; noise; ventilation; heating; etc. Paper read before Roy. Aeronautical Soc.

AIRSHIPS

R 38 DISASTER. The Loss of the "R 38". Engineering, vol. 113, no. 2931, Mar. 3, 1922, pp. 265-266. Editorial discussion of report of Accidents Investigation Sub-Committee of Aeronautical Research Committee. Fundamental error of judgment made in design appears to have been that calculations of staff failed to take into account the aerodynamic forces to which ship would be subjected in flight, and considered only forces and moments due to distribution of weight and buoyancy, including gas pressures.

ALLOY STEELS

CHROME-MOLYBDENUM. Chrome-Molybdenum-Steel Applications From the Consumer's Viewpoint, C. N. Dawe. Forging & Heat Treating, vol. 8, no. 2, Feb. 1922, pp. 109-113. Results of physical tests, comparing medium-carbon, chrome-molybdenum, chrome-vanadium, chrome-nickel and chrome steels, expressed by means of a merit index. Paper read before Soc. Automotive Engrs.

HIGH ELASTIC LIMIT. Some Alloy Steels of High Elastic Limit, Their Heat Treatment and Microstructure, Charles M. Johnston. Am. Soc. for Steel Treating Trans., vol. 2, no. 6, Mar. 1922, pp. 500-506, 13 figs. Describes non-high-speed series which are said to be most promising by reason of tensile values given in tables, and by reason by uniform, tough and dense microstructure of heat-treated condition.

STRUCTURAL, TENSILE PROPERTIES OF. Tensile Properties of Some Structural Alloy Steels at High Temperatures, H. J. French. U. S. Bur. of Standards Technologic Papers, no. 205, Dec. 21, 1921, pp. 77-92, 8 figs. Results of determination of tensile strength, proportional limit, elongation, reduction of area, and strength at fracture throughout range 20 to 550 deg. cent. for four steels containing about 0.38 per cent carbon. Brief reference is made to type of fractures obtained in testing steels at various temperatures, and particular attention is paid to comparison of tensile properties of these alloys at 550 deg. cent.

ALLOYS

BEARING-METAL. *See Bearing Metals.*

CHROMIUM. *See Chromium Alloys.*

COPPER. *See Copper Alloys.*

AMMONIA COMPRESSORS

LOSSES IN. Analysis of Losses in Ammonia Compressors, S. F. Smith. Ice & Refrigeration, vol. 62, no. 2, Feb. 1922, pp. 154-155. Discusses losses as they occur and conditions which control same.

APPRENTICES, TRAINING OF

PLANT VS. CONTINUATION SCHOOLS. The Training of Workers in Manufacture, J. V. L. Morris. Am. Mach., vol. 56, no. 7, Feb. 16, 1922, pp. 249-251. General conditions of apprenticeship; problems arising from school; plant school vs. part-time and continuation schools.

ARCHES

REINFORCED-CONCRETE. Constructing Reinforced Concrete Arches Without Scaffolding (Procédé de construction, sans cintres, des grands arcs en béton armé), Ch. Dantin. Génie Civil, vol. 80, no. 2, Jan. 14, 1922, pp. 37-40, 16 figs. Describes the Gouyaud system, in which a metal casing is substituted for concreting.

ARMATURES

LOCATING FAULTS IN D.C. Locating Faults in Direct-Current Armatures—Short-Circuits in Parallel Windings, B. A. Briggs. Power, vol. 55, no. 8, Feb. 21, 1922, pp. 303-305, 4 figs. Methods of locating defects in windings, with a low-reading voltmeter, before machine is put into service.

AUTOMOBILE ENGINES

NEW YORK SHOW. Powerplant Trends as Seen at the Show, Herbert Chase. Automotive Industries, vol. 46, no. 2, Jan. 12, 1922, pp. 62-65, 3 figs. Discusses cooling systems, aids to starting, lubrication and piston design, valves, gearing and crankshafts, etc.

AUTOMOBILES

BRAKES. Automobile Brakes, Sydney V. James. Armour Engr., vol. 13, no. 1, Nov. 1921, pp. 1-21, 9 figs. Discusses mechanics of motion as applied to brakes and braking, actual brake mechanisms and typical braking systems, including both external contracting and internal expanding types, and brake lining materials

MANUFACTURING PLANTS. A Modern Automobile Plant, Paul L. Battey. Management Engr., vol. 2, no. 3, Mar. 1922, pp. 167-172, 8 figs. Arrangement of departments, routing of product, and means of transportation. (Abstract.) Paper presented to Metropolitan Section of Am. Soc. Mech. Engrs.

The New Plant of the Fisher Body Ohio Co. (Cleveland). Power Plant Eng., vol. 26, no. 4, Feb. 15, 1922, pp. 201-209, 13 figs. Largest single-unit automobile-body manufacturing plant in world. Exemplifies modern construction in its highest degree.

PRESSED-STEEL PARTS. Making Pressed Steel Automobile Parts. Iron Trade Rev., vol. 70, no. 9, Mar. 2, 1922, p. 601-604, 8 figs. Details of plant of the Sharon Pressed Steel Co., Sharon Pa.

REPAIR-SHOP PRACTICE. Automobile Repair Shop Practice. Machy. (N. Y.), vol. 28, nos. 5, 6 and 7, Jan., Feb. and Mar. 1922, pp. 359-362, 468-470, 7 figs. and 567-568, 2 figs. Describes methods and equipment commonly employed. Feb.: Machining pistons. Mar.: Regrinding crankshaft bearings.

STATISTICS. Automobile Statistics. Automotive Industries, vol. 46, no. 7, Feb. 16, 1922, pp. [illegible]. Special number giving statistical data concerning registrations, production, specifications, exports, and general automotive statistics.

AVIATION

COMMERCIAL. Air Lines and Some of Their Problems, R. B. C. Noorduyn. Mech. Eng., vol. 44, no. 2, Feb. 1922, pp. 107-109 and 111. Detailed account of [illegible] commercial aviation in Europe, tracing development from time of post-war experimental work with military machines and fields, to present successful operation with proper machines and schedules and with Government subsidies.

DEAD RECKONING, CHECKING. Methods of Air Navigation, Herbert V. Thaden. [illegible] 1922, pp. 252-255, 6 figs. Formula and [illegible]

RESEARCH. The Progress of Research, R. K. Bagnall-Wild. Engineer, vol. 133, no. 3450, Feb. 10, 1922, pp. 161-162. Research work for air service in Great Britain comprises specific researches at establishments under control of Air Ministry, and in addition an important series of studies carried out in universities by arrangement with the Ministry. Notes on aero-engine research, navigation, and machines. See also Engineering, vol. 113, no. 2929, Feb. 17, 1922, pp. 214-216. Paper read at Air Conference, London.

B

BEAMS

REINFORCED-CONCRETE. The Rapid Calculation of Ferro-Concrete Beams, Auguste Esnouf and Leon Joseph Coutanceau. Engineering, vol. 113, nos. 2928, 2929, 2930 and 2931, Feb. 10, 17, 24 and Mar. 3, 1922, pp. 155-157, 193-195, 221-223 and 273-274, 27 figs. Calculation of T-beam without compressive reinforcement and whose neutral axis is outside slab; T-beams without compressive reinforcement, but with neutral axis inside slab; beams requiring steel in compression; rectangular beams and slabs. Examples taken from bridge practice.

BEARING METALS

ARSENICAL. Arsenical Bearing Metals, Harold J. Roast and Charles F. Pascoe. Min. & Metallurgy, no. 182, Feb. 1922, pp. 63-64. Investigation for purpose of comparing arsenical antimony-lead alloy with some of the regular bearing-metal alloys. (Abstract.) See also Am. Inst. Min. & Met. Engrs. Trans., No. 1136-N, Feb. 1922, 10 pp., 7 figs. (Complete paper.)

BELTING

LEATHER, SPECIFICATIONS. Outline of U. S. Specifications for Leather Belting, R. C. Bowker. Belting, vol. 20, no. 2, Feb. 1922, pp. 30-31. To be used by all government departments, but designed also for all consumers; now before Bureau of the Budget for consideration. (Abstract.) Address before Nat. Assn. Leather Belting Manufacturers.

WIDTH, DETERMINING. Charts for Determining Belt Widths, Thomas J. Cook. Machy. (N. Y.), vol. 28, no. 7, Mar. 1922, pp. 562-564, 3 figs. Presents charts devised by author which, it is claimed, should enable any one to ascertain at a glance the most efficient size of belt to be used for any condition which may arise.

BLOWERS

TURBO. Turbo-Blowers for Mechanical-Draft Applications. Power, vol. 55, no. 8, Feb. 21, 1922, pp. 307-308, 2 figs. Four blowers are worked in parallel and directly connected to turbine operating at 5,000 r.p.m. These machines are applied to both forced- and induced-draft purposes.

BOILER FEEDWATER

AUTOMATIC REGULATION. Automatic Feed Regulation. Mar. Engr. & Naval Architect, vol. 45, no. 533, Feb. 1922, p. 53, 1 fig. on p. 52. Describes the Mumford automatic feedwater regulator now being fitted on White Star liner "Majestic".

PRESENT-DAY. Present-Day Boiler-Room Operation, I. E. Moultrop and R. E. Dillon. Power, vol. 55, no. 10, Mar. 7, 1922, pp. 384-386, 6 figs. Discusses economical loading of turbines and boilers. Paper read before Metropolitan Sections of Am. Soc. Mech. Engrs. and Am. Inst. Elec. Engrs.

BOILER PLANTS

DESIGN. Common Faults in Boiler-Plant Design, George C. Cook. Power, vol. 55, no. 7, Feb. 14, 1922, p. 251. One of most frequent faults is said to be failure to provide sufficient space. Valves should be accessible. Influence of fuel on design.

BOILERS

SCALE REMOVAL WITH CO_2. Removing Boiler Scale with CO_2, R. J. Cross and Roy Irvin. Power, vol. 55, no. 11, Mar. 14, 1922, pp. 422-423, 1 fig. Some scales are removable by carbonated water. Work done with ordinary "soda-fountain" cylinders of liquid carbon dioxide. Preliminary tests easy to make.

SETTING. Large Combustion Chamber in Rear of Boiler, to Which Heated Air Is Admitted, Increases Efficiency, Alphonse F. Brosky. Coal Age, vol. 21 no. 7, Feb. 16, 1922, pp. 288-289, 1 fig. Air heated in flue passing under combustion chamber, is emitted through passages in bridge wall, causing combustion of unburned hydrocarbons and carbon monoxide.

TRIPLE-RIVETED BUTT JOINT. The Designing of a Triple Riveted Butt Joint L. T. Rutledge. Can. Machy., vol. 27, no. 6, Feb. 9, 1922, pp. 17-19, 1 fig. Strength of boiler shell; sketching proposed joint; resistance against tearing and crushing.

UP- VS. DOWN-DRAFT SMOKELESS. Up-Draft Versus Down-Draft smokeless Boilers Heat & Vent. Mag., vol. 19, no. 2, Feb. 1922, pp. 29-30, 1 fig. Air over fire needed only part of time; rate at which air is demanded; value of preheating air

BONUS SYSTEMS

HEAT-TREATING DEPARTMENT. A Successful Bonus System Applied to Heat Treating, A. A. Blue. Am. Soc. for Steel Treating Trans., vol. 2, no. 5, Feb 1922, pp. 430-436, 2 figs. Summarizes general principles and practical detail of a successful tried-out bonus system.

BRAKES

Bus, Hydraulic. Four-Wheel Hydraulic Brake Tried on California Bus. Elec. Ry. Jl. (Bus Transportation), vol. 59, no. 6, Feb. 11, 1922, p. 123. Brake installed in 18-passenger Pierce-Arrow bus by Pickwick Stage Co., Los Angeles, has proved highly satisfactory so far.

BRIDGES, HIGHWAY

Concrete Arch and Girder. Waterproofing, Joints and Drainage in Concrete Bridge. Eng. News-Rec., vol. 88, no. 10, Mar. 9, 1922, pp. 411-413, 2 figs. Details of practical design and construction for both arch and girder types of highway bridges. (Abstract.) Report of Committee on Reinforced-Concrete Highway Bridges and Culverts, before Am. Concrete Inst.

BRIDGES, LIFT

Bascule. New Type of Trunnion Bascule Bridge, Wabash Ry. Eng. News-Rec., vol. 88, no. 9, Mar. 2, 1922, pp. 363-364, 2 figs. Link system in design patented by Hugo Abt connects machinery girder traveling on incline with movable counterweight pivoted to bridge side of tower.

Bascule, Repairing Rolling Parts. Repairing the Rolling Parts of Two Bascule Bridges, J. B. Hunley. Eng. News-Rec., vol. 88, no. 10, Mar. 9, 1922, pp. 414-417, 8 figs. Damage to parts in rolling contact due to excessive bearing pressures producing distortion and crushing of segmental and track girders and excessive wear on tread castings.

BUILDING CODE

Standardization. Standardization of Building Codes. Eng. & Contracting, vol. 57, no. 8, Feb. 22, 1922, pp. 172-173. Suggested outline for standard building code, prepared by R. C. Marshall, Jr., presented before Asso. Gen. Contractors of America.

C

CABLES, ELECTRIC

Telephone. The Lincoln Highway of the Telephone, Harry A. Mount. Sci. Am., vol. 126, no. 3, Mar. 1922, pp. 172-173, 5 figs. Discusses technical difficulties met in laying a giant cable across mountains of Pennsylvania.

CABLEWAYS

Electric Suspension. Electric Suspension Railways with Self-Acting Grippers, P. Stephan. Eng. Progress, vol. 3, no. 2, Feb. 1922, pp. 34-37, 13 figs. Design and method of working. Describes a Bleichert electric grab suspension railway and a conveying plant for coal and coke.

CAISSONS

Sinking. The Successful Sinking of two Great Caissons, Robert G. Skerrett. Compressed Air Mag., vol. 27, no. 11, Feb. 1922, pp. 41-43, 5 figs. Describes construction and sinking of caissons at Spring and at Canal streets, New York City, for Hudson River vehicular tunnel construction.

CAR LIGHTING

Electric. Electric Illumination for Trains, Richard Hanchen. Eng. Progress, vol. 3, no. 1, Jan. 1922, pp. 1-3, 6 figs. Notes on continuous electric train lighting for individual cars; drive of dynamo; voltage control; charging and life of battery; etc.

Principles of Car Lighting by Electricity—XVII, Charles W. T. Stuart. Ry. Elec. Engr., vol. 13, no. 1, Jan. 1922, pp. 9-17, 15 figs. Describes the Gould simplex system of car lighting, consisting of a generator driven by a belt from car axle, a generator regulator panel, a lamp regulator panel mounted in a cabinet inside or under car body, and a storage battery suspended in a box under car body.

CARBON DIOXIDE

Pressure-Total-Heat Diagram. Pressure-Total-Heat Diagram For Carbon Dioxide, H. J. MacIntire. A.S.R.E. Jl., vol. 8, no. 3, Nov. 1921, pp. 211-215, 1 fig. Describes diagram, said to be accurate, clear and workable. Drawn with rectangular co-ordinates, using pressures for ordinates and total heat in B.t.u. above 32 deg. fahr. as abscissae.

CARS

Hose Connectors. Recent Changes in American Hose Connectors. Ry. Age, vol. 72, no. 6, Feb. 11, 1922, pp. 375-377, 4 figs. Describes connector manufactured by Am. Automatic Connector Co., Cleveland, Ohio, and tests made.

The Development of the Robinson Connector. Ry. Mech. Engr., vol. 96, no. 2, Feb. 1922, pp. 77-81, 9 figs. Latest type incorporates improvements suggested by extensive service of earlier design.

CARS, PASSENGER

Articulated Dining. Articulated Units Feature Recent English Car Design. Ry. Rev., vol. 70, no. 4, Jan. 28, 1922, pp. 109-113, 6 figs. Describes new dining-car train, showing advantages of articulated design and use of electricity for cooking.

Sleeping and Compartment. New Sleeping and Compartment Cars for the C.P.R. Ry. Rev., vol. 70, no. 3, Jan. 21, 1922, pp. 77-81, 8 figs. Designed for service on transcontinental trains with spe al regard for comfort of women travelers.

CASE-HARDENING

Cyanamide for. Cyanamide in Liquid Case Hardening, P. W. and E. B. Shimer. Am. Soc. for Steel Treating Trans., vol. 2, no. 5, Feb. 1922, pp. 403-408. Account of experiments made with and description of the Shimer case-hardening process, making use of special lump calcium cyanamide and easily fusible mixture of salts.

Steel, Effect of Quality on. Effect of Quality of Steel on Case-carburizing Results, H. W. McQuaid and E. W. Ehn. Min. & Metallurgy, no. 182, Feb. 1922, pp. 60-61. Writer seeks to prove that presence of excess dissolved oxides in steel, as made in melting furnace, affects permanently results obtained in carburizing and hardening and that it is possible that presence of dissolved oxide can result in total unfitness of low-carbon steel for case-hardening purposes. Abstract.) See also Am. Inst. Min. & Met. Engrs. Trans., no. 1135-S, Feb. 1922, 22 pp., 46 figs. (Complete paper.)

CAST IRON

Gray, Metallography of. Apply Metallography to Gray Iron, J. W. Bolton. Foundry, vol. 50, nos. 2 and 3, Jan. 15 and Feb. 1, 1922, pp. 52-55 and 109-112, 23 figs. Jan. 15: Describes methods of making photomicrographs, including sampling, polishing, etching and photographing. Shows means for identifying the different structures. Feb. 1: Metallurgical control of cupola.

Piping. The Piping of Cast Iron (Ueber das Lunkern von Gusseisen). Giesserei-Zeitung, vol. 19, no. 5, Jan. 31, 1922, pp. 75-81. Discussion of nature and causes of piping. Abstracts of three papers presented before South German Group of Assn. German Foundrymen, followed by discussion.

Welding Without Studding. Welding Cast Iron Without Studding, F. L. Paertch. Welding Engr., vol. 7, no. 2, Feb. 1922, pp. 28-29 (includes discussion). A process which is feasible in some cases but not recommended for strength members and live loads. Paper read before Am. Welding Soc.

CASTING

Centrifugal. Centrifugal Casting, L. Cammen. Chem. & Met. Eng., vol. 26, no. 8, Feb. 22, 1922, pp. 354-358, 4 figs. Describes process of centrifugal casting of hollow metal objects. Mechanics of centrifugal casting.

Steel Mills Rolls. Rolls Molded in Sectional Flasks, J. R. Hadsum. Foundry, vol. 50, no. 5, Mar. 1, 1922, pp. 206-207, 2 figs. Alternative method to sweep molding. Mold finished in sections and clamped together.

Tunnel Segments. Tunnel Segment Casting Methods. Foundry, vol. 50, no. 4, Feb. 15, 1922, pp. 137-141, 6 figs. Discusses technical difficulties in producing castings for lining of vehicular tunnel under Hudson River.

CELLS

Electromotive Force at Low Temperatures. Electromotive Force of Cells at Low Temperatures, G. W. Vinal and F. W. Altrup. Wash. Acad. Sciences Jl., vol. 12, no. 3, Feb. 4, 1922, pp. 64-71, 2 figs. Experimental work to determine open circuit voltage of dry cells at approximately 0 deg. Fahr. and below, and to determine whether dry cells are fit for use after they have been frozen and thawed out again. Observations on storage batteries.

CEMENT, PORTLAND

Development. The Application of the Fundamental Knowledge of Portland Cement to Its Manufacture and Use, P. H. Bates. Jl. Franklin Inst., vol. 193, no. 3, Mar. 1922, pp. 289-309, 6 figs. History of development of Portland cement. Effect of di- and tricalcium on strength. Discussion of investigations by Bur. of Standards and Geophysical Laboratory.

CENTRAL STATIONS

Operating Expenses. Operating Expenses of Six Plants. Elec. World, vol. 79, no. 3, Jan. 21, 1922, pp. 131-132. Study of Massachusetts stations emphasizes advantages of electrical equipment from upkeep standpoint. Data indicate changes which are taking place as result of transition to new industrial basis.

CHARTS

Engineering. Practical Engineering Charts, K. F. Smith. Am. Soc. Naval Engrs. Jl., 34, no. 1, Feb. 1922, pp. 56-72, 4 figs. Describes charts for graphical solution of equations with x and y, or z and w given.

CHUCKS

Magnetic. Direct current or Alternating Current for Magnetic Chucks. (Gleichstrom oder Welchseldtrom für Spamfutter), B. Wittkuhns. Elektrotechnik u. Maschinenbau (Anzeiger), vol. 40, no. 5, Jan. 29, 1922, pp. 21-22. Results of tests made on magnetic chuck for alternating current to determine its properties when compared with d.c. chucks. It is shown that only advantage of a.c. chuck is the instant demagnetization attained with its use, but there are a great many insurmountable disadvantages.

CHROMIUM ALLOYS

Expansibility. Expansibility of Chromium and Nickel-Chromium Alloys in a large Interval of Temperature (Ditalabilité du chrome et des alliages nickel-chrome dans un intervalle étendu de températures), P. Chevenard. Comptes rendus des Séances de l'Academie des Sciences, vol. 174, no. 2, Jan. 9, 1922, pp. 109-112, 2 figs. Describes experiments carried out by means of dilatometer and gives curves resulting.

COAL HANDLING

Equipment. Car Dumper and Coal Conveyors at Coke Oven Plant. Eng. News-Rec., vol. 88, no. 10, Mar. 9, 1922, pp. 407-409, 4 figs. Rotary cradle serves conveying belts. Traveling bridge has belt for storing coal and grab bucket to reclaim it.

Locomotive Loading Plant. Locomotive Coal and Ash Handling Plant. Eng. Rev., vol. 35, no. 7, Jan. 1922, pp. 226-228, 3 figs. Describes plant of Lond. & North Western Ry. Co., capable of loading loconotive in 30 sec.

COILS

Reactance. Result of Short Circuit Tests on Outdoor Type Reactance Coils, A. F. Bang. Elec. World, vol. 79, no. 9, Mar. 4, 1922, pp. 425-428, 6 figs. Tests conducted under artificial rainfall did not cause any flashovers or deformation even under severe short-circuit conditions. Saving effected in building structure by using outdoor type.

COMBUSTION

Control. Gas and Air Mixers for Combustion Control, T. L. Hiles. Forging & Heat Treating, vol. 8, no. 2, Feb. 1922, pp. 124-125. Discusses difficulties in producing a perfect combustible mixture of gas air at burner outlet of a gas furnace.

CONCRETE BLOCKS

Absorptive Qualities. Tests on Absorptive Qualities of Concrete Blocks, Stanton Walker. Eng. News-Rec., vol. 88, no. 7, Feb. 16, 1922, pp. 282-284, 8 figs. Effect of varying aggregate, cement and water content, curing conditions and density observed on small test blocks. (Abstract.) Paper presented before Am. Concrete Pipe Assn. Minn. Section.

CONCRETE CONSTRUCTION, REINFORCED

Slab Design. Graphs and Alignment Charts for the Design of Reinforced Concrete Slabs, Beams and Columns, Joseph W. Dawson. Concrete & Constructional Eng., vol. 17, no. 2, Feb. 1922, pp. 86-92, 6 figs. Presents set of graphs and charts prepared with aim of eliminating as far as possible the laborious calculation usually involved in designing of reinforced concrete construction.

CONDENSERS, STEAM

Spray-Nozzle Cooling of Condenser Water. Spray-Nozzle Cooling Theory and Practice B. H. Coffey and G. S. Dauphine. A.S.R.E. Jl., vol. 8. no. 3, Nov. 1921, pp. 177-202, 6 figs. Discusses the three varieties of variables affecting spray cooling, viz.: independent natural variables which we cannot control; independent artificial variables which we can control; and the final temperature produced by the mutual reactions of the others and, consequently, the dependent variable.

Testing Apparatus. Testing Condenser Apparatus, R. N. Ehrhart. Power vol. 55, no. 7, Feb. 14, 1922, pp. 248-250, 7 figs. How commercial tests are made on ejectors, circulating and condensate pumps.

Tubes. British Standard Specification for Condenser Tubes and Screwed Glands for Condensers for Marine Purposes. British Eng. Standards Assn., no. 145, Oct. 1921, 7 pp. 3 figs. Specifications for quality of material manufacture, dimensions, weight, hydraulic and mechanical tests, inspection and testing facilities.
Properties of Condenser Tubes. Power, vol. 55, no. 9, Feb. 28, 1922, pp. 343-344. Muntz and Admiralty metals are discussed. Effects of internal strains, crystalline structure and thickness of tubes.

CONNECTING RODS

Bearing Machine for. Universal Bearing Machine for Connecting Rods. Western Machy. World, vol. 13, no. 2, Feb. 1922, pp. 48-52, 15 figs. Designed for use in pouring and boring of bearings for automotive connecting rods. Manufactures by Automatic Bearing Machine Co., San Jose.

CONTRACT WORK

Professional Attitude Toward. Defines Professional Attitude Toward Contracting. Eng. News-Rec., vol. 88, no. 9, Mar. 2, 1922, pp. 350-351. Institute of Consulting Engineers distinguishes between professional engineering and contracting functions.

CONVERTERS

Rotary. Rotary Converters and Railway Electrification, F. P. Whitaker. Engineer, vol. 133, no. 3452, Feb. 24, 1922, pp. 221-222, 3 figs. Enumerates characteristics which a converting apparatus for railway substations should possess. Effect of frequency and d.c. voltage on general design; effect of 1500-volt direct current on detail design of converters and on general performance. (Abstract.) Paper read before Instn. Elec. Engrs.

Synchronous. An Analytical Investigation of the Causes of Flashing of Synchronous Converters, F. B. Shand. Am. Inst. Elec. Engrs. Jl., vol. 41, no. 3, Mar. 1922, pp. 175-183, 12 figs. Shows on what factors flashing tendency of synchronous converters depends, and how, an improvement of their momentary overload characteristics can be obtained. From interpretation of a number of oscillograms, and other experimental data, it is shown that a heavy load surge produces unbalanced armature reactions, resulting in abnormal voltage conditions on commutation, which are in turn largely responsible for flash. Means are enumerated by which momentary overload capacity may be increased.

CONVEYORS

Advantages. The Influence of Mechanical Conveyors Upon Financial and Operating Policies, [illegible]. Management Eng., vol. 2, no. 3, Mar. 1922, pp. 133-136, 7 figs. It is pointed out that a completely conveyorized plant automatically secures advantage of cost reduction, speedy delivery to customers, minimum capital investment, and a highly stimulated industrial organization.

Steel-Band. Novel Applications for Thin Steel Bands, Bernard Kruger. Iron Age, vol. 109, no. 10, Mar. 9, 1922, pp. 640-642. Special advantages are said to follow their use for power-transmitting and conveying purposes. Question of tension important. Paper presented before West. Soc. of Engrs.

COPPER ALLOYS

Copper-Tin-Zinc. Copper—88, Tin—10, Zinc—2, R. R. Clarke. Metal Industry (N.Y.), vol. 20, no. 2, Feb. 1922, pp. 56-57, 1 fig. Analysis of properties, idiosyncrases and methods of producing this mixture.

Phosphor-Copper. Phosphoe-Copper, J. L. Jones. Metal Industry (Lond.), vol. 20, no. 7, Feb. 17, 1922, pp. 145-146. Its uses and methods of obtaining best results.

COST ACCOUNTING

Chemical. Some Phases of Chemical Cost Accounting, C. B. E. Rosen. Chem. Age. (N.Y.), vol 29, no. 12, Dec. 1921, pp. 501-104. Discusses the question of process costs and their management.

Machine-Rate. Machine Rate Costing in Engineering Manufacturing Works, G. W. Beale. Jl. Indus. Administration, vol. 1, no 8, Dec. 1921, pp. 246-253. Series of arguments leading to the conclusion that it is not commercially profitable to include machine rate costs in the routine-recorded system of cost accounts of an engineering manufacturing works, but that it finds its true place in estimated costs.

CRANES

Electrical Apparatus for. Selection of Electrical Apparatus for Cranes, R. H. McLain. Am. Inst. Elec. Engrs. Jl., vol. 41, no. 3, Mar. 1922, pp. 249-256. Paper is intended to assist crane designers and electrical engineers in mills and factories to select proper size and kind of motor by mathematical calculation from given data, and refers particularly to electric overhead traveling crane. It is shown how to calculate power required of motor for hoisting and how to select particular kind of motor needed.

Locomotive. Getting the Maximum Performance Out of Locomotive Cranes. Ry. Maintenance Engr., vol. 18, no. 2, Feb. 1922, pp. 49-53, 2 figs. Describes the many purposes for which Lehigh Valley R.R. has found it profitable to use them in maintenance-of-way work.

CRANKPINS

Lubrication. An Analysis of a Point in Crank Lubrication. Automotive Industries, vol. 46, no. 8, Feb. 23, 1922, pp. 462-463, 10 figs. Analytical investigation to determine best location for crankpin oil holes.

CRANKSHAFTS

Balancing Machine. A New Crankshaft Balancing Machine, P. M. Heldt. Automotive Industries, vol. 46, no. 9, Mar. 2, 1922, pp. 518-519, 3 figs. Obviates need for preliminary static balance and permits of quickly determining magnitude and proper angular positions of correcting moments required to insure accurate dynamic balance.

CUPOLAS

Operation and Control. Operation and Control of Cupolas (Conduite et Contrôle des Cubilots), Maurice Bouffart. Fonderie Moderne, no. 12, Dec. 1921, pp. 372-377, 10 figs. Discusses the various chemical and physical measurements including temperature measurements in melting zone and in charge. Read before Congrès de Fonderie de Liége.

D

DAMS

Arch. The Relation Between Deflections and Stresses in Arch Dams, Am. Soc. Civ. Engrs. Proc., vol. 48, no. 2, Feb. 1922, pp. 359-566. Discussson by Albert B. Hill of paper by F. A. Noetzli published in Proceedings of Oct. 1921.

Hetch Hetchy, San Francisco. Construction Features of Hetch Hetchy Dam. Eng. & Contracting vol. 57, no. 10, Mar. 8, 1922, pp. 225-227, 3 figs. Details of construction work of gravity-type dam, principal dimensions of which are given. Notes on spillway; outlet system; stream control during construction; contract prices; excavation for foundations; construction, rock-crushing and concreting plants; cement storage and transportation.

Siphon Spillways. Siphon Spillways, G. F. Stickney. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 2, Feb. 1922, pp. 175-194, 13 figs. Deals with use of siphon for discharging water and for regulating water level at a dam, or in a canal. Describes different types of siphons and gives principles of their operation. Describes various siphon spillways in operation in United States.

DIE CASTING

Uses and Machines for. Die Casting, A. G. Hopking. Instn. Mech. Engrs. Proc., no. 1, 1922, pp. 25-35 and (discussion) 36-40, 7 figs. Deals with uses and advantages; permanent molds; lead base, zinc base, tin base, aluminum base and copper base alloys; design of dies; die-casting machines.

DIESEL ENGINES

Compressors for. The Use of Compressed Air in Diesel Engined Ships, William Reavell. Engineering, vol. 113, no. 2928, Feb. 1922, pp. 179-183, 26 figs. partly on p. 170. (Abstract.) Paper read before North-East Coast Instn. Engrs. & Shipbuilders.

Efficiency. Efficiency of the Diesel Oil Engine, L. H. Morrison. Power, vol. 55, no. 9, Feb. 28, 1922, pp. 340-341, 3 figs. Diesel engine, unlike all other prime movers, is thermally more efficient at part loads, reason for which is explained.

Marine. Some Problems of Marine Diesel Engine Design, P. Belyavin. North-East Coast Instn. Engrs. & Shipbuilders, advance proof, no. 2211-Q, for meeting Feb. 24, 1922, pp., 25 figs. Discusses important points which have a substantial influence on size, cost and weight of multi-cylinder, two-stroke-cycle Diesel engine.

DRAINAGE

Maintenance of Drains. Methods and Cost of Maintenance of Drains on U.S. Reclamation Service Projects, C. L. Leunsberry. Eng. & Contracting, vol. 57, no. 10, Mar. 8, 1922, pp. 235-236. Information on maintenance of open and tile drains on irrigation projects of U.S. Reclamation Service, abstracted from Reclamation Record, Jan. 1922.

DRILLS

Diamond. The Diamond Drill in Oil Prospecting. Petroleum Times, vol. 7, no. 160, Jan. 28, 1922, pp. 116. Discusses increased prospecting possibilities due to application of diamond drill.

DROP FORGINGS

Heat Treatment. Heat-Treatment of Drop-forgings. Machy. (Lond.), vol. 19, no. 488. Feb. 2, 1922, pp. 554-557, 5 figs. Practice followed and equipment empoyed, with special reference to furnace design and suitable fuels.

Perfecting. Perfecting a Drop Forging, J. H. G. Williams. Am. Soc. for Steel Treating Trans., vol. 2, no. 5, Feb. 1922, pp. 390-395, 13 figs. Includes photographs, showing how metal did not flow in manner originally planned, and discusses methods used for removing conditions promoting formation of defects.

DURALUMIN

Gear Material. Duralumin and Its Use as a Gear Material, Robert W. Daniels Machy. (N. Y.), vol. 28, no. 7, Mar. 1922, pp. 542-643. Notes on physical properties and general characteristics of duralumin; process of manufacture. It is said to be an ideal material for worm wheels. (Abstract.) Paper read before Am. Gear Mfrs. Assn.

DYNAMOMETERS

Hydraulic Traction. The Polak Hydraulic Traction Dynamometers. Engineering, vol. 113, no. 2931, Mar. 3, 1922, p. 256, 4 figs. Describes instrument designed by M. W. Polak, Holland, for testing agricultural machinery. It does not draw a curve, but measures average drawbar pull during certain periods, mostly of 20 sec.

E

EDUCATION

American, Foreign Criticism of. Foreign Criticism of American Education, W. J. Osburn. U. S. Dept. of Interior, Bur. of Education Bul., no. 8, 1921, 156 pp. Contains extracts of reports made by educators and critics of education from other countries who have visited American schools, usually for purpose of gaining such information and ideas as would be helpful to them in improvement of schools of their countries.

EDUCATION, ENGINEERING

Industries. Professional Engineering Education for the Industries, Francis C. Pratt. Eng. Education, vol. 12, no. 5, Jan. 1922, pp. 227-233. Discusses American methods of engineering education, based on result of careful study of large number of college graduates at works of Gen. Elec. Co. Writer is against too early specialization of student, resulting in turning out a disproportionate number of men or mediocre ability and narrowly specialized education.

Metallurgical Course. A University Course in Metallurgical Engineering, W. P. Wood. Am. Soc. for Steel Treating Trans., vol. 2, no. 5, Feb. 1922, pp. 423-425. Presents curriculum prepared by author having in mind preparation of students for those industries which are concerned with final shaping and preparing of metal for use.

Mining Curriculum. The Mining Curriculum at Lehigh University, George J. Young. Eng. & Min. Jl, vol. 113, no. 6, Feb. 11, 1922, pp. 239-242, 8 figs. partly on p. 238. Discusses curriculum.

EDUCATION, INDUSTRIAL

Industries and Railroads. A Review of Industrial Education and Training. Mech. Eng., vol. 44, no. 2, Feb. 1922, pp. 87-92. Education and Training in the Industries, R. L. Sackett. Education and Training on Railroads, D. C. Buell. Discussion.

ELECTRIC CIRCUITS

Protection by Cutouts. Cutouts in Motor Circuits and Their Location, Edgar P. Slack. Power, vol. 55, no. 10, Mar. 7, 1922, pp. 381-382, 5 figs. Where to place fuses or circuit breakers to protect circuits on which motors or other electrical devices operate to prevent fire and accident hazards.

ELECTRIC CONDUCTORS

Iron vs. Copper Wire. Iron Wire Versus Copper as an Electrical Conductor, W. E. Rice. Elec. World, vol. 79, no. 7, Feb. 18, 1922, pp. 331-332. Construction and mechanical difficulties of changing from iron to copper conductors. Practicability of iron lines. Discussed before N.E.L.A.

ELECTRIC DRIVE

Machine-Tool Shop. Individual Electric Drive in a Machine Tool Shop (La commande électrique individuelle dans un atelier de machines-outils), R. Micheau. Arts et Métiers, vol. 74, no. 10, July 1921, pp. 203-212, 25 figs. Deals with single-pulley drives, cone-pulley drives, and multiple-shaft drives, and their difficulties

ELECTRIC FURNACES

Electromagnetic Motions in. Electromagnetic Motions in Electric Furnaces, Carl Hering. Am. Electrochem. Soc. advance paper, no. 2, for meeting Apr. 27-29, 1922, pp. 7-14. Describes how new proposed law given in former paper may be applied to production, by the current, of certain desired motions such as those for circulating or stirring liquid conductors in a furnace.

Future Applications. The Electric Furnace Situation. Blast Furnace & Steel Plant, vol. 10, no. 2, Feb. 1922, pp. 137-139. Deals with widening of sphere of electric furnace's operation, including production of cast iron.

Gray Iron Castings. Electric Furnace Strengthens Iron, D. Wilkinson. Foundry vol. 50, no. 4, Feb. 15, 1922, pp. 143-145. Reviews work on production of synthetic pig iron, and describes an inexpensive type of electric furnace for gray-iron castings.

Iron Smelting. Electric Iron Smelting. Pacific Mar. Rev., vol. 19, no. 2, Feb. 1922, pp. 126-128, 2 figs. Describes "Elektrometalls" process as carried out at Tröllhattan Falls, Sweden, based on inventions made by Gronwall, Lindblad and Stalhane.

Italian Design. Italian Firm Designs An Electric Furnace. Foundry, vol. 50, no. 5, Mar. 1, 1922, p. 177, 1 fig. Describes electric Furnaces placed on market by Fiat Corp., Italian automobile builder producing 1,000 metric tons of finished steel per month.

ELECTRIC GENERATORS, D.C.

Flux Distribution in Air Gap and Teeth. Flux Distribution in Air Gap and Teeth of Dynamos, Alfred Still. Electrician, vol. 88, nos. 2282 and 2283, Feb. 10 and 17, 1922, pp. 152-153 and 187-188, 7 figs. Discusses permeance of air paths, air gap, conditions in highly saturated teeth. Calculations of tooth density in terms of air gap density and m.m.f., with correction for tapering of teeth, illustrated by numerical example.

ELECTRIC LOCOMOTIVES

Chile. Passenger Locomotives for Chilean State Railways. Elec. Ry. Jl., vol. 59, no. 8, Feb. 25, 1922, pp. 309-314, 18 figs. partly on p. 308. Describes electric locomotives for express and local service on line under electrification between Valparaiso and Santiago. See also Ry. Age, vol. 72, no. 9, Mar. 4, 1922, pp. 527-528, 3 figs.

ELECTRIC MOTORS

Railway, Heating of. Heating of Railway Motors in Service and on Test-Floor Runs, G. E. Luke. Am. Inst. Elec. Engrs. Jl. vol. 41, no. 43, Mar. 1922, pp. 165-173, 7 figs. Notes on heating and cooling characteristics of railway motors. Brief analysis of heating at standard ratings is given. Fundamental equations defining temperature rise of a motor on continuous or short-time load are developed, and applications of these equations are made in several specific examples. Bibliography.

ELECTRIC RESISTANCE

Materials, Specifications of. British Standard Specification for Metallic Resistance Materials for Electrical Purposes. British Eng. Standards Assn., no. 115, Sept. 1921, 13 pp. Specifications for resistivity, variation and uniformity of resistance, thermal electromotive force, temperature coefficient, maximum working temperature, quality, mechanical properties of wire and tape, etc. Standard sizes of wires, thicknesses of sheets and strips and dimensions of tapes.

Neutralization. Resistance Neutralization, Edward Bennett and Leo James Peters. Am. Inst. Elec. Engrs., Jl., vol. 41, no. 3, Mar. 1922, pp. 234-248, 13 figs. An application of thermionic amplifier circuits. Discusses current and power relations which obtain in circuits having a resistance neutralizer associated with them; and treats of optimum conditions in receiving circuits containing a resistance neutralizer.

ELECTRIC WELDING

Cyc-Arc. The "Cyc-Arc" Process of Automatic Electric Welding, L. J. Steele and H. Martin. Instn. Elec. Engrs., Jl., vol. 60, no. 305, Jan. 1922, pp. 136-157 and (discussion) 158-162, 14 figs. Detailed description of the processes, by which metals of widely differing character and section can successfully be welded electrically.

Steel Construction. Electric Welding Applied to Steel Construction, with Special Reference to Ships, A. T. Wall. Engineering, vol. 113, no. 2930, Feb. 24, 1922, pp. 241-244, 14 figs. Writer calls attention to various ways in which electric welding is being applied to ship construction, and indicates further possibilities in this connection for steel structures. Paper read before Instn. Mech. Engrs.

ELECTRIC WELDING, ARC

Cast Iron. Arc-Welding of Cast Iron. Machy. (Lond.), vol. 19, no. 490, Feb. 16, 1922, pp. 593-596, 6 figs. Use and application of methods for welding cast iron by electric arc.

Practical Points. Practical Points in Arc Welding, J. A. Wilson, Am. Mach., vol. 56, no. 10, Mar. 9, 1922, pp. 357-358, 4 figs. Notes on keeping work clean; bevelling edges; allowing for expansion and contraction; guarding against injury; making solid welds.

Refrigerating Machinery. Arc Welding of Refrigerating Machinery, A. M. Candy. Welding Engr., vol. 7, no. 2, Feb. 1922, pp. 21-23, 9 figs. Advantages in repair and production work. Paper read before Am. Soc. Refrig. Engrs.

ELECTROLYSIS

Underground Pipe. Prevention of Electrolysis Troubles in Underground Pipe Structures, E. B. Stewart. Am. Water Works Assn. Jl., vol. 9, no. 2, Mar. 1922, pp. 274-283. Discusses electrolytic problems most generally encountered by pipe-owning companies and methods of mitigating them.

ELEVATORS

Motor Controller. Operation of a Drum-Type, Elevator-Machine Alternating-Current Motor Controller, William Zepernick. Power, vol. 55, no. 8, Feb. 21, 1922, pp. 295-298, 9 figs. Functions of different parts and circuits of a one-speed elevator controller. Tracing out circuits for one direction of machine.

Passenger, Safeguarding. Passenger Elevator Protection, J. J. Lamb. Power Plant, Eng., vol. 26, no. 4, Feb. 15, 1922, pp. 231-234, 3 figs. Arrangement and safeguarding to prevent accidents and reduce fire hazard to a minimum.

EMPLOYEES' REPRESENTATION

Shop Committees. How Shop Committees Function Under Depression, Lionel D. Edie. Indus. Management, vol. 63, no. 2, Feb. 1922, pp. 92-95. Account of what happened to shop committees of Int. Harvester Co., and how these committees have handled lay-offs and wage reductions. Record includes wage cut of 20 per cent decided entirely by shop committees.

EMPLOYEES, TRAINING OF

Manufacturing. The Training of Workers in Manufacture, J. V. L. Morris. Am. Mach., vol. 56, no. 9, Mar. 2, 1922, pp. 320-322. Apprenticeship practices regarding indenture, age, payment and certificates. Public School substitutes. Evening, part-time and cooperative schools.

Methods. Making Industrial Improvements Permanent, Paul M. Atkins. Management Eng., vol. 2, no. 3, Mar. 1922, pp. 153-158, 4 figs. Through patient teaching based on written instructions. Two classes of employee instruction. Specific forms of training.

EMPLOYMENT MANAGEMENT

Eye Examinations. Better Work and More Work per Man Through Better Sight, E. LeRoy Ryer and Willard B. Fisher. Indus. Management, vol. 63, no. 2, Feb. 1922, pp. 111-117, 2 figs. Industrial eye examinations and their importance in management.

Principles Involved. Increasing Man Power Through Management, L. W. Olson. Indus. Management, vol. 63, no. 2, Feb. 1922, pp. 88-91. Writer discusses cardinal principles involved in management of men.

Testing Motormen. Psychological Tests for Motormen, Alfred Gradenwitz. Elec. Ry. Jl., vol. 59, no. 4, Jan. 28, 1922, pp. 143-146, 13 figs. Discusses physical and psychological tests which must be passed by candidates for position of motormen in Berlin.

ENGINEERING

Economics of. The Economics of Engineering, H. W. Pitt. Eng. Production, vol. 4, nos. 73 and 74, Feb. 23 and Mar. 2, 1922, pp. 173-175 and 197-199. Feb. 23: Deals with design economics; production and consumption cost; designing for a given market; standardization and accuracy as cost reducers; designing and costing. Mar. 2: Designer and consumer; production and factory economics; division of labour; economics of purchasing and of selling and using.

ENGINEERS

Licensing. Licensing and Engineering Ethics, C. E. Waddell. Professional Engr., vol. 7, no. 1, Jan. 1922, pp. 8-9. Status of the expert witness, contractor, manufacturer, salesman, college graduate and practising engineer.

EVAPORATORS

Basic Principles. Evaporators—What They Are and How They Operate. Power, vol. 55, no. 8, Feb. 21, 1922, pp. 292-294, 3 figs. Writer seeks to present clear idea of basic principles of evaporators as used in power plants to produce distilled makeup water

F

FACTORY MANAGEMENT

See Industrial Management.

FILTRATION PLANTS

Loading. The Loading of Filter Plants, H. W. Streeter. Am. Water Works Assn. Jl., vol. 9, no. 2, Mar. 1922, pp. 157-171, 2 figs. It is shown how bacterial correlation between influent and effluent, such as is described, may be utilized in practical way as basis of predicting probable loading conditions under which water-purification plants are likely to become overburdened, as far as their producing effluents of specified bacterial quality is concerned.

FLIGHT

Soaring. Soaring Flight, Its Development and Prospects, Wm. Knight. Aerial Age, vol. 14, no. 24, Feb. 20, 1922, pp. 562-563, 8 figs. Describes Klemperer and Loessl gliders, and gives tables of distance and time of flights made.

FOREMEN

Requirements and Training. Can Foremanship Help to Rebuilt Profits? B. M. Nussbaum. Indus. Management, vol. 63, no. 3, Mar. 1922, pp. 155-159. Notes on cost saving and the foreman; foremen as advisers to directors; train- [illegible] foremanship.

FOUNDRIES

[illegible] Conveying and Mechanical Handling [illegible] vol. 20, no. 6, Feb. 10, 1922, pp. 123-127, 3 figs. Emphasizes necessity of keeping foundry handling costs [illegible] to the end.

Dust Removal from Cleaning Room. Removing the Dust from the Casting Cleaning Room, C. C. Hermann. Indus. Management, vol. 63, no. 3, Mar. 1922, pp. 171-174, 3 figs. Design of suitable system requires competent consideration of (1) suction at hoods; (2) friction losses in piping; (3) selection of blower unit; (4) discharge resistance; (5) losses due to collector.

Gas, Application in. The Application of Gas in the Foundry. Foundry Trade Jl., vol. 25, no. 286, Feb. 9, 1922, pp. 97-100, 7 figs. Describes way in which Mond gas generated at works of Nat. Gas Engine Co., Ltd., is fully utilized. Plant consists of a gas generator, scrubber, gas purifier, exhauster and pressure regulator.

Machine-Tool Industry. Machine Builder Erects Foundry, Pat Dwyer. Iron Trade Rev., vol. 70, no. 10, Mar. 9, 1922, pp. 683-686, 7 figs. Melting and crane equipment was installed sufficient to handle single castings up to 50 tons and daily normal output of 100 tons of castings. Details of new foundry of Toledo Machine & Tool Co., Toledo, Ohio.

Modern Designs. Modern Foundries, M. Fischer. Eng. Progress, vol. 3, no. 2, Feb. 1922, pp. 29-32, 14 figs. Principles governing construction of modern foundries as regards initial costs, enlargement, workmen, and auxiliary arrangements.

FREIGHT HANDLING

Container System. Containers Carry Freight in Cincinnati. Elec. Ry. Jl., vol., 59, no. 8, Feb. 25, 1922, pp. 315-318, 8 figs. An interurban electric railway without tracks downtown gives through freight service by containers which are carried on motor trucks within city and on electric cars for interurban run.

Electric Tractors and Trailers. Modern Methods of Handling Package Freight, G. Marks. Ry. Age, vol. 72, no. 8, Feb. 25, 1922, pp. 469-470. Use of electric tractors and trailers in freight houses, and savings effected on New Haven line. (Abstract.) Paper read before New Eng. R. R. Club.

Erie Railroad. Erie Adopts Direct Freight Delivery at New York. Ry. Age, vol. 72, no. 3, Jan. 21, 1922, pp. 233-234, 1 fig Plan involves breaking bulk at Jersey City, N.J., and use of auto trucks, tractors and trailers and ferries.

FUELS

Gas. Burning Fuel Gases Efficiently, H. S. Watts. Iron Trade Rev., vol. 70, no. 9, Mar. 2, 1922, pp. 605-609, 2 figs. Combustion temperature and stack loss are important factors from standpoint of economy. Design and operation of gas burners and principles of continuous heating are discussed.

Fuel Gases and Their Use in Iron and Steel Plants, H. S. Watts. Assn. Iron & Steel Elec. Engrs., vol. 4, no. 2, Feb. 1922, pp. 97-126, 5 figs. Characteristics of gases; design and operation of gas burners; principles of continuous heating.

High-Ash Coal. Low-Ash Coal Not Always Desirable, S. W. Flagg. Power, vol. 55, no. 9, Feb. 28, 1922, pp. 328-330, 4 figs. Discussion of conditions under which it was found that coal with high ash content reduced stoker trouble.

Sawmill Refuse. Generating Power from Waste, H. S. Bastian. Elec. World, vol. 79, no. 8, Feb. 25, 1922, pp. 373-375, 5 figs. "Hogged fuel," or sawmill refuse, proves to be a valuable combustible in lumber-producing regions; care must, however, be exercised in firing if best results are to be obtained.

FURNACES, ANNEALING

Sheet and Tin Mill. Sheet and Tin Mill Furnaces, T. J. Costello and J. H. Knapp. Blast Furnace & Steel Plant, vol. 10, no. 2, Feb. 1922, pp. 141-144, 3 figs. Improvements in furnaces used for heating and annealing sheet and tin.

FURNACES, FORGING

Types. Discussion of Forge Furnaces, Charles Longenecker. Forging & Heat Treating, vol. 8, no. 2, Feb. 1922, pp. 122-124. Discusses soaking pits, regenerative-type furnaces, non-regenerative type, and furnaces of small hearth area, pointing out possibilities for saving and increased efficiency with various classes of fuel.

G

GARBAGE DISPOSAL

Methods. Present Day Aspects of the Refuse Disposal Problem, Samuel A. Greeley. Western Soc. Engrs. Jl., vol. 27, no. 2, Feb. 1922, pp. 33-44 and (discussion) 44-46, 9 figs. Refuse disposal in large and small towns; house treatment, collection, transportation, and final disposal; describes modern garbage reduction plants.

GAS

By-Product. Value of By-Product Gas to Industry, H. Dobrin. Assn. Iron & Steel Elec. Engrs., vol. 4, no. 2, Feb. 1922, pp. 79-90 and (discussion) 91-96. Flame temperatures of various gases; use of by-product gas in glass, iron, boiler, and automobile works; furnace design; combustion.

Fuel. *See Fuels, Gas.*

GAS ENGINES

Manufacture of Parts. How Large Engine Parts Are Made, Pat Dwyer. Foundry, vol. 50, nos 2 and 3, Jan 15 and Feb 1, 1922, pp. 66-73 and 114-119, 18 figs. Jan. 15: Molding practice at plant of Allis Chalmers Co., West Allis, Wis., in production of what are claimed to be largest gas engines in world. Feb. 1: Handling of large engine castings after they are made.

GAS PRODUCERS

Benoid Automatic. Benoid Gas Producer. Eng. Progress, vol. 3, no. 2, Feb. 1922, pp. 37-38, 2 figs. Arrangement, drive and [illegible] of an automatically acting gas producer, properties of gas suitable for [illegible] and heating purposes.

Coupled to Gas-Engine Plant. Some Observations on a Producer-Gas Power Plant, H. S. Denny. Engineering, vol. 113, nos. 2926, 2927 and 2928, Jan. 27, Feb. 3 and 10, 1922, pp. 119-122, 152-154 and 184, 10 figs. Account of investigation of large-capacity Mond gas-producer plant coupled up to gas-engine plant of equivalent size. Paper read before Instn. Mech. Engrs. For discussion, see no. 2928, Feb. 10, pp. 160-162.

GAS TURBINES

Economy. Economy and the Gas Turbine, Norman Davey. Engineer, vol. 133, no. 3451, Feb. 17, 1922, p. 177. Gives comparative analyses of gas-turbine cycles (heat absorption at constant pressure) working with common rotary compressor and with kinetic compressor. Writer maintains that gas turbine competes essentially with steam turbine. (Letter to editor.)

Efficiency, Determination of. Thermodynamic Bases for Determining Efficiency to be Expected from Gas Turbines, H. Schmolke. Mech. Eng., vol. 44, no. 3, Mar. 1922, pp. 187-190, 4 figs. Presents, among others, diagrams developed by W. Schüle showing process and efficiency of Holzwarth turbines. Translated from Zeit. für Dampfkessel u. Maschinenbetrieb, vol. 44, no. 44, Nov. 4, 1921, p. 351.

GAS WORKS

Chemical Problems. Solved and Unsolved Problems in Gasworks Chemistry, E. V. Evans. Chem. Age (Lond.), vol. 6, no. 139, Feb. 11, 1922, pp. 168-169. Notes on naphthalene deposits in mains; removal of hydrogen sulphide; reduction of dyestuffs; low-temperature carbonization; etc. (Abstract.) Paper read before Roy. Soc. of Arts.

GASES

Heat Transfer Between Liquids and. Rates of Absorption and Heat Transfer between Gases and Liquids, W. G. Whitman and J. L. Keats. Jl. Indus. & Eng. Chem, vol. 14, no. 3, Mar. 1922, pp. 186-191, 3 figs. Presentation of theory involved in liquid-gas interactions. Summary of Lewis' mathematical treatment with modifications. Verification of theory. Presentation of equations showing effect of operating variables on coefficients for various types of apparatus.

GEAR CUTTING

Multiple Shaper. Develops Multiple Shaper for Intern Gears. Iron Age, vol. 109, no. 9, Mar. 2, 1922, pp. 592-593, 4 figs. Down-stroke model supplements previous machine of Stevenson Gear Co., Indianapolis; essential features retained.

Planing Spur Gears. Planing Large Spur Gears, Franklin D. Jones. Machy. (N. Y.), vol. 28, no. 7, Mar. 1922, pp. 529-532, 6 figs. Application of gear planers which cut gear teeth by reproducing shape of templet.

Tooth-Chamfering Machine. Gear Tooth Chamfering Machine. Machy. (Lond.), vol. 19, no. 488, Feb. 2, 1922, p. 558, 4 figs. Describes machine built by Parkinson & Son, Shipley. Effect of chamfer on engagement of gears.

Worm-Gear Generator. A New Worm Gear Generator. British Machine Tool Eng., vol. 2, no. 13, Jan.-Feb. 1922, pp. 439-445, 9 figs. Describes 12-in. worm-gear generator of Smith & Coventry, Ltd., Manchester.

GEARS

Bevel-Gear Testing Machine. The Saurer Bevel Gear Testing Machine. Engineering, vol. 113, no. 2930, Feb. 24, 1922, pp. 228-229, 9 figs. Bed of machine is heavy, circular casting, upon which a pair of sliding heads can be locked in any position, so that angle between axes of heads corresponds to that of bevels to be tested, a range from 52 to 150 deg. being obtainable.

Chain. The Application of Chain Gearing, H. T. Hildage. Can. Manufacturer, vol. 42, no. 2, Feb. 1922, pp. 31 and 51. When adaptable to certain needs; type of chain required; what it will cost, how much space it will occupy, how long it will last.

Friction. Friction Gearing, Chas. S. Pettit. Machy. (Lond.), vol. 19, no. 489, Feb. 9, 1922, pp. 567-569. Discusses frictional contact between driving and driven members ;coefficient of friction; pressures of contact; variable-speed disc drives; cup and cone friction clutches; etc.

Herringbone. Standardization of Herringbone Gears, Am. Mach., vol. 56, no. 9, Mar. 2, 1922, pp. 329-330, 2 figs. Recommendations which are result of careful investigation by committee of Am. Gear Mfrs. Assn.

Hot-Rolling. Forming Gears by Hot Rolling, Reginald Trautschold. Iron Trade Rev., vol. 70, no. 6, Feb. 9, 1922, pp. 396-399, 6 figs. Independent application of power to die roll and gear blank and synchronization of their rotation are said to be factors contributing to success of gear-rolling processes.

Spiral Bevel. End Thrusts and Bearing Loads due to Spiral Bevel Gears. Machy. (Lond.), vol. 19, no. 488, Feb. 2, 1922, pp. 545-548, 4 figs. Discusses pinion-cut left-hand spiral, rotating clockwise; pinion-cut left-hand spiral, rotating counter-clockwise; pinion-cut right-hand spiral, rotating clockwise; and pinion-cut right-hand spiral, rotating counter-clock-wise.

GRAVEL

New Hampshire Road Material. Systematic Survey of Gravel for Road Purpose, Wallace F. Purrington. Good Roads, vol. 62, no. 7, Feb. 15, 1922, pp. 100 and 102-103. Experiences in testing of gravels in New Hampshire.Paper presented before Am. Road Builders' Assn.

GRINDING MACHINES

Plain. A New Precision Grinding Machine. Machy. (Lond.), vol. 19, no. 488, Feb. 2, 1922, pp. 532-534, 5 figs. Plain grinder with positive-acting table traverse and reversing mechanism

H

HEATING

Central Producer-Gas Plant. Central Heating by Steam, Water or Gas, Samuel R. Lewis. Power vol. 55, no. 7, Feb. 14, 1922, pp. 267-268. Central producer-gas plant with automatic gas-fired boilers in each building shows an estimated saving in initial investment of $173,000 and a reduction in annual operating expense of $14,700 over steam heating.

Gas. Possibilities of Gaseous Heating, H. H. Clark. Western Soc. Engrs. Jl., vol. 27, no. 2, Feb. 1922, pp. 51-56 and (discussion) 56-58, 5 figs. Relative combustion efficiency of the various gases assuming perfect combustion; comparison of costs of various fuels; comparison of gas and electricity for heating, power and light. Gives a number of charts.

HEAVY-OIL ENGINES

Naphthalene. Naphthalene Engines (Moteurs à naphthaline), P. Maréchal. Nature, no. 2493, Jan. 14, 1922, pp. 22-23, 1 figs. Describes operation of a recent type in which fuel is vaporized by gasifying at low temperature, which makes engine run smoothly.

HIGHWAYS

Maintenance. The Highway Maintenance System of Pennsylvania, W. A. Van Duzer. Eng. & Contracting, vol. 57, no. 9, Mar. 1, 1922, pp. 196-198. Its organization and operation. Paper read before Assn. State Highway Officials.

HOUSES, CONCRETE

Kent System. Colonel Kent's Patent System of House Construction, H. V. Kent. Royal Engrs., Jl., vol. 35, no. 2, Feb. 1922, pp. 87-92, 5 figs. partly on supp. plate. System based on "Pier and Panel" principle, piers being of reinforced concrete, anchored into foundations, and panels consisting of long thin slabs of concrete, or other suitable material, which bridge spaces between piers. Piers and slabs are precast.

HOUSING

National Problem. The National Housing Problem. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 2, Feb. 1922, pp. 196-263. Symposium containing following papers followed by discussion: Broad Economic Phases of the Housing Problem, Lawson Purdy. Housing: Broad Economic Aspects, John M. Gries. National Housing Problem: Planning and Zoning Joseph C. Wagner. Relation of Zoning to the Housing Problem, B. Antrim Haldeman. City Planning in Relation to the Housing Problem, Charles M. Reppert. Water Supply, H. Malcolm Pirnie. Basic Principles of the Public Sewerage of Municipalities, W. L. Stevenson. Paper on legislation and financing, by Allan Robinson, Edward M. Bassett, William H. Ham, and John Ihlder.

Railway Workmen's Dwellings. On the Question of Workmen's Dwellings (All Countries except America), Fausto Lolli. Int. Ry. Assn. Bul., vol. 4, no. 2, Feb. 1922 pp. 359, 418, 12 figs. Replies to following question: How is problem of dwellings for their workmen and lower-grade emp oyees solved by railway? How do administrations assist individual efforts made by staff, in particular as regards building of dwellings for use of laborers and employees?

HYDRAULIC TURBINES

Draft-Tube Designs. A Discussion of Draft-Tube Designs, Webster K. Ramsay. Mech. Eng., vol. 44, no. 3, Mar. 1922, pp. 171-176, 11 figs. With special reference to recent forms known as hydraucone regainer and spreading draft tube.

Flow in Conival Draft Tube. Flow in Conical Draft Tubes of Varying Angles, George E. Lyon. Mech. Eng., vol. 44, no. 3, Mar. 1922, pp. 177-180, 7 figs. Account of investigation to determine velocity curves at several cross sections of straight conical draft tubes.

Measuring Efficiency. New Methods for Measuring the Efficiency of Hydraulic Turbines (Note sur un nouveau procédé de mesure du rendement des turbines hydrauliques), L. Barbillion and A. Poirson. Bul.Technique del a Suisse Romande, vol. 48, no. 2, Jan. 21, 1922, pp. 19-21, 1 fig. Describes thermometric method by which losses are measured from temperature difference of water before and after passing turbine.

HYDROELECTRIC DEVELOPMENTS

Canada. A Review of Hydro-Electric Progress in Canada. Can. Engr., vol. 42, no. 8, Feb. 21, 1922, pp. 241-244, 3 figs. Progress in developments during 1921, 300,000 hp. installed in Dominion, with 177,000 hp. in Ontario and 90,000 hp. in Quebec.

Ontario System. Hydro-Electric System of Province of Ontario Investigated, W. S. Murray. Elec. World, vol. 79, no. 10, Mar. 11, 1922, pp. 471-474. In report made public by Nat. Elec. Light Assn. writer finds it inefficient, expensive, and wasteful and that, in spite of all claims made for it, service from private utilities in United States and Canada is cheaper and better.

SHAWINIGAN FALLS, CANADA. The New 41,000 Hp Unit at Shawinigan Falls, Julian C. Smith. Eng. Jl. (Eng. Inst. Can.), vol. 5, no. 3, Mar. 1922, pp. 134-139, 7 figs. Describes design features of latest hydroelectric development of Shawinigan Water & Power Co.

ST. LAWRENCE RIVER. St. Lawrence Navigation and Power Investigations. Can. Engr., vol. 42, no. 3, Jan. 17, 1922, pp. 139-145, 1 fig. Details of double development plan as proposed by New York & Ontario Power Co. Suggestions based on 14 years' study of conditions in vicinity of Waddington. Proposed sites at Rapid du Plat and Long Sault.

HYDROELECTRIC PLANTS

HIGH-HEAD. Highest Head Hydroelectric Power Installations of the World, A. T. Parsons. Jl. Electricity & Western, vol. 48, no. 4, Feb. 15, 1922, p. 155. Discusses limiting factors entering into design and construction of hydroelectric plants for very high heads.

INTERCONNECTION OF STEAM AND. Michigan a Leader in Interconnection of Hydro and Steam Plants, Harry J. Burton and William W. Tefft, Elec. World, vol. 79, no 7, Feb. 18, 1922, pp. 328-331, 2 figs. Twenty water-power and eleven steam stations joined by Consumers' Power Company's 140-Kv. transmission system. Bearing of hydro experience on Middle Western developments. How some problems have been solved.

I

ICE PLANTS

ELECTRICALLY OPERATED. 300-Ton Ice Factory at Grimsby. Engineer, vol. 133, no. 3451, Feb. 17, 1922, pp. 171-173, 5 figs. Describes what is believed to be largest electrically operated direct-expansion ice-making plant in world, recently erected and put to work for Standard Ice & Cold Storage Co., Ltd., by Pluperfeet Refrigeration Co., Ltd., Manchester, England.

Central Station Service in the Ice Industry, H. M. Jones. Ice & Refrigeration, vol. 62, no. 2, Feb. 1922, 136-138. Electric drive for ice-making plants; power required; kind and size of motors; comparative cost of operating.

RAILWAY. Establishing Icing Facilities on a Large Scale, W. C. Phillips. Ry. Age, vol. 72, no. 9, Mar. 4, 1922, pp. 533-534, 2 figs. System recently inaugurated on Southern Pacific and Union Pacific gives highly satisfactory results.

IMPACT TESTING

ENDURANCE TESTS. Impact Endurance Tests of Rods of Varying Cross-Section, Engineering, vol. 113, no. 2930, Feb. 24, 1922, p. 246. Describes endurance tests to which W. Müller and H. Leber, of the Material Testing Bureau at Darmstadt. Germany have been submitting rods of varying cross-section. Translated from Zeit. des Vercines deutscher Ingenieure (pp. 1089-1094, 1921).

INDUSTRIAL MANAGEMENT

FORMS. The Principles of Designing Forms, H. P. Losely, Management Eng., vol. 2, no. 3, Mar. 1922, pp. 158-160, 3 figs. Presents and discusses five principles governing design and use of forms.

INVENTORY METHODS. How to Cut Cost Corners Through Inventory, W. M. Romig. Indus. Management, vol. 63, no. 2, Feb. 1922, pp. 86-87, 2 figs. How well managed inventory methods help to stabilize profits.

LABOR ROUTINE CHART. Labor Routine. Indus. Management, vol. 63, no. 3, Mar. 1922, pp. 176-177. Presents chart developed for Todd Dry Dock & Constr. Co. by William C. Bober showing how systems of routine may be charted to bring out each step.

PLANNING. Planning in Large Contract Plants, George H. Shepard. Machy. (N.Y.), vol. 28, no. 7, Mar. 1922, pp. 547-551, 13 figs. Cards and records used in planning and dispatching work.

PRODUCTION CONTROL. The Measurement of Human Work, Walter N. Polakov. Management Eng., vol. 2, no. 2, Feb. 1922, pp. 91-93, 1 fig. The Gantt graphic method of controlling production is claimed to be only one on a correct unit of measurement.

PRODUCTION ORGANIZATION. Organization of Production, J. W. Curtis. Eng. & Indus. Management, vol. 7, nos. 5 and 7, Feb. 2 and 16, 1922, pp. 127-130 and 187-191, 19 figs. Discusses use of charts, and organization in erection work. Presents scheme of organization of engineering department of a medium-size works. Drawing office progress chart.

PURCHASING POLICIES. Stabilizing Profits through Proper Purchasing Policies, Park Mathewson. Indus. Management, vol. 63, no. 3, Mar. 1922, pp. 136-139. How Purchasing executive should apply fundamentals of forecasting.

REDUCED FORCE. Operating with. Operating a Factory with a Reduced Force, John C. Lease. Machy. (N.Y.), vol. 28, no. 7, Mar. 1922, pp. 533-535, 3 figs. Describes how factory was profitably operated at 30 per cent capacity.

SALES ORGANIZATION. Sales Organization and Methods, Willard E. Freeland. Taylor Soc. Bul., vol. 6, no. 6, Dec. 1921, pp. 244-251 and (discussion) pp. 251-254. Second report of committee on sales questionnaire, purpose of which was to obtain information about form of organization of sales departments, extent to which engineering phases were recognized and scientific planning and scheduling attempted and methods of control of important portions of work of distribution organization.

STANDARD LOT QUANTITIES. Establishing Profitable Standard Lot Quantities, J. A. Bennie. Indus. Management, vol. 63, no. 3, Mar. 1922, pp. 167-169, 2 figs. How to determine order points for stock parts.

TIME STUDY. *See Time Study.*

INDUSTRIAL ORGANIZATION

ADMINISTRATION PROBLEMS. Works Organization, T. E. Pattinson. Eng. Production, vol. 4, nos. 70 and 71, Feb. 2 and 9, 1922, pp. 101-104 and 124-127, 18 figs. Deals mainly with problems which have been encountered in administration of a large works organization. Paper presented before Instn. Production Engrs. See also discussion in same journal, no. 72, Feb. 16, 1922, pp. 149-152.

FUNDAMENTALS. The Body, Soul and Spirit of Organization, B. A. Franklin. Indus. Management, vol. 63, no. 3, Mar. 1922, pp. 143-145. Discusses fundamentals underlying organizing for accomplishment.

PROFIT MARGINS, RE-ESTABLISHING. Re-establishing the Profit Margins in the Edison Industries, Alfred Stuart Myers. Indus. Management, vol. 63, no. 3, Mar. 1922, pp. 131-135. Describes executive policies that successfully met problems of depression.

PROFITS, STABILIZING. Stabilizing the Profits of the Small Factory, Ernest Cordeal. Indus. Management, vol. 63, no. 3, Mar. 1922, pp. 146-149. Author points out necessity of constant attention to raw-material market, probable demand for product and stability of wage scales, and shows how useless any cost system may become unless it is intelligently followed up.

INTERNAL-COMBUSTION ENGINES

CASTINGS FOR. Some Castings for Internal Combustion Engines, Ben Shaw and James Edgar. Foundry Trade Jl., vol. 25, no. 285, Feb. 2, 1922, pp. 83-87, 26 figs. Deals with patternmaking for crankcases drawing board, and core-boxes.

FUELS, EFFECT OF. Effect of Different Fuels on the Operation of Internal-Combustion Engines (L'influence de l'emploi de combustibles différents sur le fonctionnement des moteurs à combustion interne). Henri Petit. Technique Automobile et Aerienne. vol. 12, nos. 113, 114 and 115, 1921, pp. 50-62, 72-87 and 97-115, 33 figs. No. 113:

HOT-BULB MARINE. Internal Combustion Engine, J. J. Fasola. Inst. Mar. Engrs. Trans., vol. 33, Jan. 1922, pp. 583-628, (includes discussion) 10 figs. Fundamentals and other particulars relating to a modern hot-bulb marine engine.

See also Airplane Engines; Automobile Engines; Carburetors; Diesel Engines; Gas Engines; Heavy-Oil Engines; Oil Engines.

IRON

ELECTROLYTIC DEPOSITION. Electrolytic Deposition of Iron for Building up Worn or Undersized Parts, David R. Kellogg. Min. & Metallurgy, no. 182, Feb. 1922, p. 61. Describes method successfully used in commercial work for production of repaired parts of automotive machinery. (Abstract.)

L

LABOR TURNOVER

UNAVOIDABLE, ELEMENTS OF. Elements of Unavoidable Labor Turnover, A. L. DeLeeuw. Management Eng., vol. 2, no. 3, Mar. 1922, pp. 137-142, 5 figs. It is maintained that labor turnover of whatever kind provides measure of management efficiency because its cost is an overhead expense.

LABORATORIES

FOUNDRY. Laboratory for Malleable Iron Foundry. Iron Age, vol. 109, no. 10, Mar. 9, 1922, pp. 643-644, 3 figs. Equipment for running carbon, sulphur and manganese determination facilitates control of product. Getting rid of heavy gases.

INDUSTRIAL. Research Laboratories in Industrial Establishment of the United States. Nat. Research Council, Bul., vol. 3, no. 16, Dec. 1921, 135 pp. List of laboratories arranged by firm names, with a subject classification, giving particulars as to research staff, research work and equipment in each case. Originally compiled by Alfred D. Flinn, revised and enlarged by Ruth Cobb.

LATHES

BED GUARDS. Durability in Machine Tools, P. V. Vernon. Eng. Production, vol. 4, no. 72, Feb. 16, 1922, pp. 153-154, 3 figs. Describes Herbert automatic lathe fitted with bed guards, introduced in 1910, and new model no. 11 hexagon turret lathe, embodying similar protective devices.

FAY, MACHINING ON. Cutting the Production Cost of a Difficult Part, H. A. Loudon. Am. Mach., vol. 56, no. 10, Mar. 9, 1922, pp. 369-370, 6 figs. Describes machining of one of its own parts, the cam drum worm, by the standard Fay lathe.

TURRET. Motor-car Engine Production Work on Turret Lathes. Machy. (Lond.) vol. 19, no. 489, Feb. 9, 1922, pp. 570-573, 8 figs. Time-saving and cost-reducing methods for engine department of a motor-car plant.

LIGHTHOUSES

AERIAL. Aerial Lighthouses. Aerial Age, vol. 14, no. 24, Feb. 20, 1922, pp. 564-565 and 561, 2 figs. Describes lighthouse being erected at Dijon in order to provide suitable guiding light for aerial routes between Paris and Algiers, Italy and Switzerland. Made by optical firm of Barbier Bernard and Turenne, Paris.

LIGHTING

ARTIFICIAL DAYLIGHT. Recent Improvements in the Sheringham Daylight, S. H. Groom. Illuminating Engr., vol. 14, no. 9, Nov. 1921, pp. 215-218, 4 figs. Principles upon which Sheringham daylight is based and recent improvements made.

Factory. Better Lighting Increases Production, Ward Harrison, O. F. Haas and J. W. Dopke. Iron Trade Rev., vol. 70, no. 9, Mar. 2, 1922, pp. 610-612, 2 figs. Account of investigation carried out by Dover Mfg. Co., Dover, Ohio, in its plant for purpose of obtaining further practical data showing effect of good lighting on efficiency of production.

LIGHTNING

Protection Against. Lightning Protection. Elec. World, vol. 79, no. 8, Feb. 25, 1922, pp. 376-380, 3 figs. Abstracts of articles presented before Am. Inst. Elec. Engrs. on arrester and ground-wire practice; use of Petersen coil; protecting windings against transients; defense of standard practice in lightning arresters; and economic value of overhead grounded wire.

LOCOMOTIVES

Cylinders. Locomotive Cylinders, Ry. Gaz., vol. 36, no. 4, Jan. 27, 1922, p. 138, 2 figs. Describes method of L. B. Billinton, of Lond., Brighton & South Coast Ry., and results obtained, for renewing port faces of locomotive cylinders which have become prematurely worn to scrapping limits.

Mikado and 8-Wheel. Mikado Locomotive for the Greenbrier & Eastern Railroad and Eight-Wheel Type Locomotive for the Dayton-Goose Creek Railroad. Ry. & Locomotive Eng., vol. 35, no. 2, Feb. 1922, pp. 42-43, 2 figs. Describes Mikado 2-8-2, with tractive effort of 45,750 lb., and eight-wheel 4-4-0 type, with tractive effort of 13,770 lb., Built by Baldwin Locomotive Works.

New Baldwin Locomotives for Short Line Railroads. Ry. Rev., vol. 70, no. 7, Feb. 18, 1922, pp. 213-214, 2 figs. Describes Mikado type built for Greenbrier & Eastern R. R., with tractive effort of 45,750 lb.; and 4-4-0 American type built for Dayton-Goose Creek Ry., with tractive effort of 13,770 lb.

Northern Pacific Ry. Extensive Order of New Locomotives for the Northern Pacific Railway Company. Ry. & Locomotive Eng., vol. 35, no. 2, Feb. 1922, pp. 35-36, 3 figs. Describes Pacific type 4-6-2, Mikado type 2-8-2, and Mallet type 2-8-8-2, built by Am. Locomotive Co., with tractive efforts of, respectively, 41,900 lb., 57,100 lb., and 105,100 lb.

Ownership and Operation. Factors in the Business of Owning Locomotives, C. B. Peck. Ry. Age, vol. 72, no. 8, Feb. 25, 1922, pp. 471-474. Discusses co-operation between locomotive power and operating departments in designing and operating to secure economy. Paper read before Western Ry. Club.

Rebuilt. Operating Results Show Savings by Rebuilt Power, H. F. Grewe. Ry. Age, vol. 72, no. 7, Feb. 18, 1922, pp. 423-424, 2 figs. Gives locomotive data comparative mileages and expenses; operating costs.

The Passing of the Cross-Compound. Ry. Rev., vol. 70, no. 8, Feb. 25, 1922, p. 265, 2 figs. Describes conversion of a number of ten-wheel type cross-compound locomotives into simple locomotives of same type equipped with superheaters and piston valves.

Shay Geared. Shay Geared Locomotives for Mountain Roads. Ry. Mech. Engr., vol. 96, no. 2, Feb. 1922, pp. 75-76, 3 figs. 150-ton locomotive of Shay geared three-truck type with gear ratio of 1 to 2.45; for Greenbriar, Cheat & Elk Railroad. Comparison with heavy Mikado.

Speed Indicators. The Telco Locomotive Speed-Indicator and Recorder. Engineering, vol. 113, no. 2927, Feb. 3, 1922, pp. 131-133, 27 figs. Describes instrument constructed by Hasler Telegraph Works, London, having an ordinary clock movement which gives actual time and which is combined with gear producing a time record; also a distance counter, and speed-recording gear.

Steam-Turbine. The First Steam Turbine Locomotive. Ry. Mech. Engr., vol. 96, no. 2, Feb. 1922, pp. 69-70, 3 figs. Describes locomotive designed by Belluzzo, in 1908; maximum rotative speed of turbines was 2400 r.p.m. at 28 m.p.h.

Turbine Characteristics and Design of Turbo-Locomotives. Ry. Mech. Engr., vol. 96, no. 2, Feb. 1922, p. 61. Editorial discussing difficulties that must be overcome to apply the turbine to locomotives.

Zoelly Turbine Locomotive for Swiss Federal Railways. Ry. Mech. Engr., vol. 96, no. 2, Feb. 1922, p. 70. Describes new design of Dr. Zoelly, of Escher, Wyss & Co., Zurich, Switzerland. A 4-6-0 type locomotive has been converted from a standard type with usual reciprocating steam engine to turbine-driven engine. Turbine is designed for speed of 8000 r.p.m. or 48½ m.p.h.

LUBRICATING OILS

Airplane Engines. Paraffin viz. Naphthene Base Oils. Sci. Lubrication, July 1921, pp. 5-8 and 13, 4 figs. Describes tests made for purpose of deciding various questions regarding lubrication of aeronautic engines with oils from Texas, Pennsylvania, and oils compounded with graphite.

Cutting Fluids. Cutting Fluids, Eugene C. Bingham. U. S. Bur. of Standards Technologic Papers, no. 204, Dec. 20, 1921, pp. 35-76, 8 figs. Used both to cool and lubricate. When lubrication is more important, it is generally recognized that fatty oils are superior to mineral oils, through reason has never been clearly explained. Evidence appears to be that value of fatty oils is due to their residual valence or acidity which causes their adhesion to metal to be greater than is case with mineral oils. Points out that it may yet be possible to synthesize an oil which has all of virtues of lard oil without its defects.

Dilution. Dilution of Crankcase Oil, C. M. Larson. Sci. Lubrication, Oct. 1921, pp. 13-15, 2 figs. Dilution of motor oils and possible means of preventing or correcting this condition in immediate future. Suggests that new instruments recently developed for detecting dilution be used by motorists, and that motors be drained as soon as instruments show mixture in crankcase has reached dangerous condition.

Light Force-Feed. Endurance Tests of Force Feed Oils, J. G. O'Neill. Sci. Lubrication, Aug. 1921, pp. 5-10, 10 figs. Results obtained from endurance test of oils to ascertain service obtained from light force-feed lubricating oils when used in a force-feed lubrication system. Character of changes which take place in these oils under severe service conditions. Reprinted from Jl. Am. Soc. Naval Engrs., May 1921.

Tests. Comparative Lubricating Engineering. Sci. Lubrication. Oct. 1921, pp. 20-22. Describes tests made to bring out relative lubricating qualities of various oils and tests made to determine most satisfactory and efficient lubricant for elevator worm gears.

Viscosity. Lubrication and Lubricants, Leonard Archbutt. Soc. Chem. Industry Jl., vol. 40, no. 24, Dec. 31, 1921, pp. 287T-293T. Discusses theory of viscous lubrication; measurement and expression of viscosity; effect of pressure on viscosity and density; solid contact friction; oiliness and its measurement; thickness of lubricating films; solid lubricants.

How variation of Temperature Affects Viscosity of Lubricating Oils, W. F. Osborne. Power, vol. 55, no. 11, Mar. 14, 1922, pp. 420-421, 1 fig. Includes chart showing how viscosities vary with temperature.

LUBRICATION

Lubrication Engineering. The Status of Lubrication Engineering, W. H. Bailey. Sci. Lubrication, Oct. 1921, pp. 5-7. Discusses conservation of lubricants and liquid fuels, and basis from which these commodities are derived. Outlines purposes of Am. Soc. Lubricating Engrs.

Thickness of Oil Films in Bearings. The Thickness and Resistance of Oil Films in High Speed Bearings, Gerald Stoney, R. O. Boswall and J. Massey. Engineering, vol. 113, no. 2931, Mar. 3, 1922, pp. 249-250, 7 figs. Account of experimental investigation carried out during 1921 at College of Technology, Manchester, England for purpose of determining actual thickness of oil film or of discovering in what way this thickness changes with variations in load, rubbing speed and viscosity.

M

MACHINE TOOLS

Anti-Slip Devices. Anti-Slip Devices Save Time and Money, Fred Horner. Can. Machy., vol. 27, no. 8, Feb. 23, 1922, pp. 19-20, 8 figs. Positive stops to prevent sliding; serration on tool face; anti-slip thrust screws; etc.

Electric Drive for Reversing. Electric Drive for Reversing Machine Tools, A. L. Harvey. Am. Mach., vol. 56, no. 10, Mar. 9, 1922, pp. 371-373. Notes on reversing mechanisms; dynamic braking and "plugging;" power consumed in reversing; effect of reversing on production; variation in power requirements.

MALLEABLE CASTINGS

Reactions in Malleablizing. Studies Reactions in Malleablizing, Arthur Phillips and E. S. Davenport. Foundry, vol. 50, no. 5, Mar. 1, 1922, pp. 185-194, 49 figs. Describes results of experiments showing effect of different temperatures and length of anneal.

METALLURGY

Time Factor in. The Time Factor in Metallurgy, C. A. Edwards. Metal Industry (Lond.), vol. 20, no. Feb. 10, 1922, 128-130. Importance of Effect of time in cooling of Metals; dynamic stresses; effect of temperature; tempering cold-worked copper; quenching temperatures. (Abstract.) Read before Inst. of Metals.

METALS

Calorizing. Calorizing, Arthur V. Farr. Engrs. Soc. West. Pa. Proc., vol. 37, no. 6, July, 1921, pp. 331-340 and (discussion) pp. 341-343. Description of calorizing based upon standard methods as practised under General Elec. Co.'s patent rights.

Colloidal State. Colloidal State in Metals and Alloys—III and IV, Jerome Alexander. Chem. & Met. Eng., vol. 26, nos. 4 and 5, Jan. 25 and Feb. 1, 1922, pp. 170-172 and 201-207, 11 figs. Jan. 25, White metal and brass. Feb. 1: Iron and Steel. Paper read before Am. Inst. Min. & Met. Engrs.

Failure Due to Internal Stress. The Failure of Metals Through the Action of Internal Stress Irregularities with Special Reference to Tool Steels, J. Neill Greenwood. Faraday Soc. Trans., vol. 17, part 1, no. 49, Dec. 1921, pp. 123-138, 6 figs. Investigation of basic reasons for failures and measures for minimizing their occurrences. Bibliography.

Heat Treatment. Heat Treatment of Metals (Les traitements thermiques des métaux), R. Panaud. Outillage, vol. 243, no. 3, Jan. 21, 1922, pp. 73-75, 13 figs. Tempering baths; temperature and methods of tempering and effect on steel and other metals.

Tests for Automotive Industries. Correlation Between Metallurgical and Service Tests, Walter Rosenhain, Automotive Industries, vol. 46, no. 10, Mar. 9, 1922, pp. 566-568. Discusses need for greater cooperation between metallurgical and automotive engineers with a view to developing tests, result of which can be used with greater certainty of success in selecting most suitable metals for various purposes.

Thermal Expansion. Thermal Expansion of Nickel, Monel Metal, Stellite, Stainless Steel and Aluminum, Wilmer H. Souder and Peter Hidnert. U. S. Bur. of Standards Sci. Papers, no. 426, Dec. 17, 1921, pp. 497-519, 10 figs. Data on thermal expansion of 29 samples are presented, all of which except stainless steel, were examined from room temperature to about 600 deg. cent. Samples of stainless steel were heated from room temperature to 900 deg. cent.

METRIC SYSTEM

Russia. The Metric System in Russia (Le systême métrique en Russie), Léopold Reverchon. Nature, no. 2491, Dec. 31, 1922, pp. 427-428. Discusses degrees adopting metric system and gives table of equivalents.

MILLING CUTTERS

Top and Side Rake. Formed Milling Cutters and Hobs with Top and Side Rake, Harry E. Harris. Machy. (N.Y.), vol. 28, no. 7, Mar. 1922, pp. 527-528, 2 figs. Summarizes chief advantages of providing a hook on hob and cutter teeth.

MILLING MACHINES

Locomotive Bar Frames. Profile Milling Locomotive Bar Frames. Machy. (Lond.), vol. 19, no. 490, Feb. 16, 1922, pp. 600-601 5 figs. Describes machine developed by Ernest Schiess, of Düsseldorf, with object of completely machining locomotive bar frames of about 4 in. in thickness from solid slab as furnished by rolling mills.

MINERAL OILS

Paraffin Wax, Effect of. Effect of Paraffin Wax on the Properties of Mineral Oils, A. P. Bjerregaard. Jl. Indus. & Eng. Chem., vol. 14, no. 3, Mar. 1922, pp. 215-217, 4 figs Known quantities of components of known properties were mixed, and viscosity, freezing point, and specific gravity of mixtures were determined.

MINING

Canada. Mining and Milling at the Hollinger Mine. Can. Inst. Min. & Metallurgy Bul., no. 119, Mar. 1922, pp. 326-354, 13 figs. Describes property of Hollinger Consolidated Gold Min. Co., and the Mining operations, including diamond drilling, stoping, underground transportation, sampling, hoisting; also describes milling operations.

Mining Operations at the McIntyre Porcupine Mines, Limited. Can. Inst. Min. & Metallurgy Bul., no. 119, Mar. 1922, pp. 355-382, 20 figs. Geology; stoping, surveying and sampling, safety work, pumping, etc.

MOLDING MACHINES

Hydraulic Jar-Ramming. French Molding Methods Arc Rapid. Foundry, vol 50, no. 4, Feb. 15, 1922, pp. 153-155, 7 figs. Describes new jar-ramming machine employing hydraulic principle.

MOLDING METHODS

Roll Methods. Diverse Methods of Roll Molding, R. H. Palmer. Foundry, vol. 50, no. 4, Feb. 15, 1922, pp. 159-163, 16 figs. Rolls cast in solid chills swung on supporting columns; some poured on end and others on side; various methods of gating are described.

MONEL METAL

Uses and Properties. Some Typical Uses and Properties of "Monel" Metal, Edwin S. Wheeler and Robert J. McKay. Engrs.' Soc. West Pa. Proc., vol. 37, no. 6, July 1921, pp. 311-324 and (discussion) pp. 325-330. Deals with occurrence and metallurgy; typical properties; typical and special uses.

MOTION STUDY

See *Time Study, Motion Study and.*

MOTOR BUSES

Eight-Wheel. Eight Wheels Improve Riding Qualities. Elec. Ry. Jl. (Bus Transportation), vol. 59, no. 6, Feb. 11, 1922, pp. 121 and 123, 4 figs. Describes new Californian bus. Has double-axle construction at both front and rear so that virtually it has two trucks. Front four wheels steer in unison; drive to four rear wheels is through two sets of worm and gear axles.

Local Railway Service. A Gasoline Motor Bus for Local Railway Needs (Automotrice à essence et à deux essieux pour chemins de fer d'intérêt local), G. Tartary. Génie Civil, vol. 80, no. 5, Feb. 4, 1922, p. 115, 1 fig. Describes new car seating 16 passengers, put in service by Deux-Sevres Tramway Co.

Snow Removal for. Fighting Snow on Suburban Routes. Elec. Ry. Jl. (Bus Transportation), vol. 59, no. 6, Feb. 11, 1922, pp. 103-104, 4 figs. Use of passenger buses with plows attached, for clearing snow.

MOTOR TRUCKS

Double-Reduction Axles. New Double Reduction Truck Axle. Automotive Industries, vol. 46, no. 8, Feb. 23, 1922, pp. 458-459, 2 figs. Describes new double-reduction design by John Thomson Press & Mfg. Co.

Sream. 5-Ton Steam Wagon with Uniflow Engine, Engineering, vol. 113, no. 2928 Feb. 10, 1922, pp. 162-163, 23 figs. partly on supp. plate. Describes tipping model embodying the Atkinson uniflow engine and auxiliary tipping engine, which can lift body and bring it back into position in two minutes.

O

OFFICE MANAGEMENT

Cutting Clerical Cost. Cutting the Clerical Cost, Henry Anson Piper. Indus. Management, vol. 63, no. 2, Feb. 1922, pp. 119-124, 7 figs. Planning pro- [illegible]

Scientific. The Application of the Principles of Scientific Management to the Office, William Henry Leffingwell. Bul. of Taylor Soc., vol. 7, no. 1, Feb. 1922, pp. 2-24 and (discussion) 24-26, 13 figs. Discusses planning and control, standardization, investigation and research, inspection and maintenance of quality, [illegible]

OIL ENGINES

Scott-Still. A New Development in Marine Propulsion. Engineering vol. 113, no. 2928, Feb. 10, 1922, pp. 177-178. Includes report by H. Riall Sankey on series of trials on Scott-Still engines for a Holt vessel, and gives details of engines.

OIL FUEL

Competition with Coal. Why Fuel Oil Must Continue to Compete with Coal, E. J. Billings. Power, vol. 55, no. 11, Mar. 14, 1922, pp. 417-419. Points out that fair comparison of fuel oil with coal cannot be made on basis of B.t.u. alone. Allowance must be made for higher efficiency and reduced operating expenses.

Gasification System. A System for Complete Fuel Gasification. Automotive Industries, vol. 46, no. 9, Mar. 2, 1922, pp. 509-510, 2 figs. Involves use of device for mechanical agitation of mixture, retort for heating entire charge above vaporization temperature of least volatile elements, and means for admixture of small quantities of exhaust gas to prevent detonation.

Vaporization. A Discussion of Present Methods of Fuel Vaporization, N. Julien Thompson. Automotive Industries, vol. 46, no. 9, Mar. 2, 1922, pp. 515-517, 2 figs. Preparation of fuel air mixtures for combustion prior to admission to cylinder.

OIL SHALES

Saturated and Unsaturated. A Study of the Saturated and Unsaturated Oils From Shale, C. W. Botkin. Chem. & Met. Eng., vol. 26, no. 9, Mar. 1, 1922, pp. 398-401. Results of experimental work on compositions and properties of lighter fractions and heavy undecomposed residues resulting from pyrolytic treatment of crude shale oils.

OIL WELLS

Fire Fighting. Combating an Oil-Well Fire, Arthur B. Clifford. Iron & Coal Trades Rev., vol. 104, no. 2814, Feb. 3, 1922, pp. 158. Discusses methods of extinguishing, oil-well fire, and employment in connection with it of Proto self-contained breathing apparatus. Effects of oil on apparatus. See also Colliery Guardian, vol. 123, no. 3188, Feb. 3, 1922, p. 279.

OILS

Linseed, Vanadium Driers for. Vanadium Compounds as Driers for Linseed Oil, F. H. Rhodes and K. S. Chen. Jl. Indus. & Eng. Chem., vol. 14, no. 3, Mar. 1922, pp. 222-224, 2 figs. Describes vanadium driers possessing certain advantages not shown by lead, manganese, or cobalt driers in common use, which should prove very satisfactory in preparation of certain types of paint and varnish.

OPEN-HEARTH FURNACES

Design. Open-Hearth Furnace Design, A. D. Williams. Iron Age, vol. 109, no. 9, Mar. 2, 1922, pp. 577-579, 3 figs. Calculations for hearth area, depth of metal, incline of parts and velocity of gases.

OSCILLOSCOPE

Operation. The Oscilloscope Motor Transport, vol. 34, no. 883, Jan. 30, 1922, pp. 123-124, 3 figs. Describes invention by means of which it is possible to examine any fast-running machinery either as if it were running at 1/100 of its actual speed, or, at will, as if it were stationary.

OXY-ACETYLENE CUTTING

Under Water. Submarine Cutting Torch Under Water, Robert G. Skerrett. Iron Age, vol. 109, no. 10, Mar. 9, 1922, pp. 637-639, 5 figs. Broken siphon pipe burned off by electric torch under 50 ft. of water, Discusses American progress in Submerged metal cutting.

OXY-ACETYLENE WELDING

Blowpipe Investigation. An Investigation of Oxy-acetylene Welding and Cutting Blowpipe, with Especial Reference to Their Design, Safety, and Economy in Operation, Robert S. Johnston. U. S. Bur. of Standards Technologic Papers, no. 200, Dec. 28, 1921, pp. 3-108, 71 figs. Apparatus from 14 of most prominent manufacturers were tested under standardized conditions. None of commercial cutting blowpipes procurable appear to be designed according to definite, theory and none are efficient in cutting metal of all thicknesses, none were correctly designed, nor free from flash-back phenomena. With properly designed welding blowpipe, it is believed that satisfactory fusion welds may be made.

Explosions, Prevention of. Dangers from the Use of Acetylene Gas and in Oxy-Acetylene Welding. Eng. & Indus. Management, vol. 7, no. 7, Feb. 16, 1922, pp. 192-193. Precautionary methods are given which should be observed by all employed in welding work. Deals with explosions in generator houses; high-pressure systems; and care of cylinders. Based on official memorandum issued by Factory Department of British Home Office.

P

PAINTS

Mineral Fillers. Non-metallic Mineral-filler Industry, W. M. Weigel. Min. & Metallurgy, no. 182, Feb. 1922, pp. 59-60. Common mineral fillers are white clay, barite, mica, talc, whiting, ocher, silica, graphite and slate, methods of mining and preparation of which are discussed separately. (Abstract.)

PAPER MANUFACTURE

Load Regulator for Pulp Grinders. Automatic Load Regulator for Motor-Driven Pulp Grinders, W. H. Artz. Chem. & Met. Eng., vol. 26, no. 8, Feb. 22, 1922, pp. 367-369, 4 figs. Describes apparatus, its operation, and advantages.

Process and Machinery. Paper Making and Paper Making Machinery, Ellsworth Sheldon. Am. Mach., vol. 56, no. 9, Mar. 2, 1922, pp. 317-319, 6 figs. Forest is principal source of raw material. Process is continuous from grinding wood to winding finished sheet of paper.

Southern Pine Refuse. The Manufacture of Paper and By-Products from Southern Pine Refuse, Joseph H. Wallace. Worcester Polytechnic Inst. Jl., vol. 25, no. 2, Jan. 1922, pp. 65-79, 3 figs. Discusses manufacture of chemical fiber suitable for Kraft wrapping or book paper and test board by-product manufacture of naval stores; destructive distillation of trash; improvement of lands.

PAVEMENTS

Bituminous Foundations. Bituminous Foundations for Street and Road Pavements, Hugh W. Skidmore. Can. Engr., vol. 42, no. 8, Feb. 21, 1922, pp. 247-248. Discusses rigid and flexible types of pavements and cites cases where "black base" has been used. Advantages of bituminous concrete. Paper read before Good Roads Congress of Am. Road Builders' Assn.

Structural Design. The Structural Design of Pavements. A. T. Goldbeck. Can. Engr., vol. 42, no. 7, Feb. 14, 1922, pp. 223-226, 3 figs. Sub.-base consideration and economic depth of foundation, pressure distribution and impact effects shown by tests; drainage of subgrade an important factor. (Abstract.) Paper read before Conference on City Paving, Philadelphia.

PAVEMENTS, ASPHALT

Grading Sand for Sheet Asphalt. The Selection and Proportioning of Sands for Sheet Asphalt Paving Mixtures, Prevost Hubbard. Contract Rec., vol. 36, no. 8, Feb. 22, 1922, pp. 176-179, 8 figs. Discusses three-group method of grading, and use of triaxial diagram in proportioning two and three sands.

PAVEMENTS, CONCRETE

Calcium Chloride, Curing with. Calcium Chloride in Concrete Highway Construction, B. H. Piepmeier and H. F. Clemmer. Eng. News-Rec., vol. 88, no. 10. Mar. 9, 1922, pp. 409-411, 2 figs. Laboratory and field tests indicate accelerated setting and more economical curing method than usual practice.

Mixers and Finishing Machines. Paving Mixers and Finishing Machines. Eng. News-Rec., vol. 88, no. 8, Feb. 23, 1922, pp. 320-323. Instructions gathered from manufacturers and uses of concrete paving machines and determined by field observations on many operations.

PIERS

Reinforced-Concrete. Reinforced Concrete Piers and Marine Works, W. Noble Twelvetreses. Concrete and Constructional Eng., vol. 17, no. 2, Feb. 1922, pp. 105-109 and (discussion) pp. 109-110. Deals with quays, wharves, jetties and piers; caissons and pontoons; slipways and shipbuilding berths; landing stages and coast-protection works. (Abstract.) Paper read before Concrete Inst.

PIPING

Air-Pressure Drop Through. Air Pressure Drop Due to Small Pipe, W. A. Shmidheiser. Power Plant Eng., vol. 26, no. 4, Feb. 15, 1922, pp. 234-235, 1 fig. Describes experiment made to determine air pressure drop through 1½-in. pipe.

PISTON RINGS

Design and Uses. The Piston Ring—Lilliputian in Size, Giant Among Parts in Technical and Commercial Importance, Morris A. Hall. Raw Material, vol. 5, no. 1, Feb. 1922, pp. 13-18, 10 figs. Discusses design, forms, and uses.

Locomotive. The "Rowan" Type of Piston Rings For Locomotives. Ry. Gaz., vol. 36, no. 4, Jan. 27. 1922, p. 137, 1 fig. Describes rings patented by William Rowan, of Belfast.

PISTON RODS

Packing for High Pressure. Packing a Rod For 500,000 lbs. Pressure, P. W. Bridgman. Power House, vol. 15, no. 3, Feb. 5, 1922, pp. 25-27, 4 figs. Describes principle of packing and some details of its application. Results of high-pressure experiments.

PISTONS

Manufacturing Plant. A Piston Manufacturing Plant, G. M. Ellis. Western Machy World, vol. 13, no. 2, Feb. 1922, pp. 53-55, 7 figs. Describes plant of W. H. Jahns at Los Angeles, methods and equipment used.

POWER PLANTS

Design. Developments in Power Station Design. Engineer, vol. 133, nos. 3450 and 3452, Feb. 10 and 24, 1922, pp. 148-150, 6 figs. and 201-204, 5 figs. Feb. 10: Describes Usco air heater of Underfeed Stoker Co., and the Howden air heaters for marine work. Feb. 24: Notes on high-pressure steam turbines.

Instructing Operators. Instructing Power-Plant Operators, J. A. MacMurphy. Power, vol. 55, no. 7, Feb. 14, 1922, pp. 260-262. Problems of making operator familiar with equipment for which he is responsible. Methods of providing proper instructions.

PRESSES

Notching. Notching Press for Automatic Plates and Segments. Engineer, vol. 133, no. 3451, Feb. 17, 1922, p. 188, 2 figs. Constructed with object of providing machine whereby armature plates or segments thereof may be notched internally or externally, in accurate and continuous manner.

Safety Devices. Safety Devices for Power Presses. Machy. (Lond.), vol. 19, nos. 474 and 487, Oct. 27, 1921 and Jan. 26, 1922, pp. 96-99 and 523-525, 16 figs. Oct. 27: Various types of gate guards. Jan. 26: Deals with gate, stationary and sliding guards provided for power press equipment of Cleveland Metal Products Co.'s plant, Cleveland, Ohio.

PRODUCER GAS

Analysis. Graphical Treatment of Stack Gas Analysis and of Producer Gas Analysis—II, W, Trinks. Blast Furnace & Steel Plant, vol. 10, no. 2, Feb. 1922, pp. 131-135, 8 figs. Graphical representation of producer-gas analysis. Review of graphic charts as introduced by W. Ostwald.

PULVERIZED COAL

Combustion. Combustion of Pulverized Fuel, F. P. Coffin. Combustion, vol. 6, no. 3, Mar. 1922, pp. 129-132, 1 fig. Chemistry of combustion; ash; flames; velocities of fuels; preheating air for combustion; control of furnace temperature. (Excerpt.)

Evaporative Tests. Pulverized Coal (Le Combustible pulvérisé), Charles Baron. Mémoires et Compte rendu des Travaux de la Société des Ingénieurs Civils de France, vol. 74, nos. 7-8-9, July -Sept. 1921, pp. 403-411, 1 fig. Details of evaporation tests carried out at various plants to show efficiency of powdered coal burning.

PUMPING ENGINES

Vertical Triple-Expansion. The Vertical Triple-Expansion Pumping Engine, L. A. Quayle and F. H. Brown. Mech. Eng., vol. 44, no. 3, Mar. 1922, pp. 155-161 and (discussion) pp. 161 and 176, 5 figs. Study of pumping-engine installations at Cleveland, Ohio, during past 65 years. New record performance at Division Ave. pumping station.

PUMPS, CENTRIFUGAL

Water Leakage. On the Leakage of Water through the Clearance Rings in a Centrifugal Pump, Otogorô Miyagi. Technology Reports of Tôkohu Imperial University, vol. 2, no. 3, 1921, pp. 1-16, 3 figs. Notes on pressure difference at clearance rings; quantity of leakage; volumetric efficiency; loss of head due to leakage. Numerical example is given.

PYROMETERS

Maintenance. Some of the Difficulties Experienced in Maintaining a Pyrometer Installation in a Works, Robert S. Whipple. Ceramic Soc. Trans., vol. 21, Part 1, Session 1921-22, pp. 1-23, 7 figs. Chief difficulties experienced with pyrometers and methods by which they can be overcome or avoided. Same article in French, pp. 24-43.

R

RADIODYNAMICS

Control of Automotive Devices. Radio Control, H. H. Germond and W. P. F'ynn. Wisconsin Engr., vol. 26, no. 5, Feb. 1922, p. 87, 1 fig. Discusses development of radiodynamics and describes a radio-controlled cart.

RADIOTELEGRAPHY

Technical Report. Imperial Wireless Telegraphy—A Technical Report. Electrician, vol. 88, no. 2281, Feb. 3, 1922, pp. 130-132. Discusses report of Wireless Telegraphy Commission appointed to make recommendations regarding sites and apparatus for stations of Imperial Wireless Chain. Includes discussion of development of high-power thermionic sets, cost of valve renewals, choice of wave length, transmitting antenna, masts and towers, methods of reception and design of receiving stations.

RAILLESS TRACTION

Rail vs. Trackless Transportation Versus Rail Transportation, Karl A. Simmon. Elec. Ry. Jl., vol. 59, no. 6, Feb. 11, 1922, pp. 233-236, 2 figs. Advantages and disadvantages of trolley, auto bus, and trackless trolley. Draws definite conclusions as to field for which each type of vehicle is most suitable.

RAILS

Failures. French Investigation of Rail Failures. Charles Fremont. Iron Age, vol. 109, no. 8, Feb. 23, 1922, pp. 523-524, 8 figs. Causes of increasing number. Effect of exfoliation. Rapid corrosion of rails. Segregation and poor-quality metal. Translated from Génie Civil, Nov. 19, 1921.

Heads Conditions Affecting. Conditions Which Affect the Head of the Rail, James E. Howard. New York R. R. Club Official Proc., vol. 32, no. 3, Jan. 20, 1922, pp. 6611-6619 and (discussion) 6619-6625. Discusses strains in rails due to cooling; formation of cracks; rail tests; rail failures; etc.

Internal Fracture. The Presence of Internal Fracture in Steel Rails and Their Relation to the Behavior of the Material under Service Stresses, Henry S. Rawdon. Faraday Soc. Trans., vol. 17, part 1, no. 49, Dec. 1921, pp. 110-116, 7 figs. Discusses discontinuities or internal fractures, in some types of steel rails and in other wrought-steel products, evidently serving as "nucleus" or starting point from which larger defects, termed transverse fissures, grow, under stress conditions to which rails are subjected in practice.

Loads, Action of. Action of Rolling Loads on Rails (Etude de l'action des charges roulantes sur les rails), S. Timochenko. Le Génie Civil, vol. 79, no. 26, Dec. 24, 1921, pp. 555-556. Assumes the rail as a bar of infinite length on a continuous elastic base, and develops formulas.

RAILWAY CONSTRUCTION

Reinforced Concrete, Use of. On the Question of Reinforced Concrete (Holland), C. Leemans. Int. Ry. Assn. Bul., vol. 4, no. 2, Feb. 1922, pp. 347-358, 16 figs. Use of ordinary concrete and reinforced concrete on state railways of Java and Sumatra.

RAILWAY ELECTRIFICATION

Chile. Electrification of the Chilean State Railways. Ry. Rev., vol. 70, no. 6, Feb. 11, 1922, pp. 185-188, 5 figs. Application of hydroelectric power; details of electrification; direct current system considered best suited to conditions.

England. London, Brighton & South Coast Railway Electrification, Philip Dawson. Ry. Gaz., vol. 36, no. 6, Feb. 10, 1922, pp. 209-211, 1 fig. Report on proposed substitution of electric for steam operation of suburban, local and main-line passenger and freight services. (Abstract.)

France. The Foremost French Railway Electrification Project, G. de la Rochette. Ry. Rev., vol. 70, no. 5, Feb. 4, 1922, pp. 148-152, 6 figs. Midi Railway is developing water power for local industries and operation of 1850 miles of line. Will generate 396,000 hp. in six big hydroelectric centers.

Improvements Due to. Electrification and Its Relation to Steam Railroads, N. W. Storer. St. Louis Ry. Club Official Proc., vol. 26. no. 9, Jan. 13, 1922, pp. 188-197 and (discussion) 197-208. Discusses improvements due to electrification, and electric locomotives.

RAILWAY MAINTENANCE

Ditching Machines. Railway Ditching Machines and Performance Records. Eng. News-Rec., vol. 88, no. 10, Mar. 9, 1922, pp. 390-393, 5 figs. Wing-type ditchers clear track ditches and dress slopes rapidly and cheaply. Comparative cost of hand, team and machine work.

RAILWAY MANAGEMENT

Freight Loss and Damage. Prevention of Freight Loss and Damage, Joe Marshall. Can. Ry. Club Proc., vol. 21, no. 1, Jan. 1922, pp. 19-36 and (discussion) 36-40. Discusses claim prevention, the various kinds of damages for which claims are made, etc.

RAILWAY MOTOR CARS

Converted AutoT rucks. Making Motor Rail Cars from Auto Trucks, Donald A. Hampson. Ry. Rev., vol. 70, no. 6, Feb. 11, 1922, pp. 191-192, 2 figs. Describes a two-car Reo train, built by J. B. Worchester Co., Middletown, N. Y., for Alabama road, with seating capacity of 24 in. each car, and operating crew of two.

Developments. Recent Developments in the Railcar Field. Automotive Industries, vol. 46, no 10. Mar. 9, 1922, pp. 556-557, 5 figs. Describes car of Indiana Truck Corp. and that of Service Motor Truck Co. Both fitted with regular and special reverse gear-sets which make possible high-speed operation in either direction, and both employ four-wheel leading trucks with live axles running in plain bearings.

Gasoline. Operating Results with Gasoline Motor Cars. Ry. Age, vol. 72, no. 9, Mar. 4, 1922, p. 516. Describes operation of Bowen motor cars by Pittsburgh and Shawmut Company to reduce cost of maintaining passenger service.

RAILWAY OPERATION

Automatic Train Control. Automatic Train Control on the Chesapeake & Ohio Ry. During the Big Snow Storm. Ry. Rev., vol. 70, no. 8, Feb. 25, 1922, pp. 257-258. Report from Calvin W. Hendrich, of Am. Train Control Co., Baltimore, of behavior of his system of automatic train control during recent heavy snow fall.

G. R. S. Company's Auto-Manual Train Control. Ry. Age, vol. 72, no. 9, Mar. 4, 1922, pp. 521-523, 6 figs. Improvements of automatic train-control system of Gen. Ry. Signal Co., Rochester, N.Y.

Train Control Test on Raritan River. Ry. Signal Engr., vol. 15, no. 2, Feb. 1922, pp. 58-60, 2 figs. Describes automatic train control of "M-V All Weather" Train Controller Co. of Newark, N.J., and tests carried out on Central of New Jersey.

Webb Automatic Train Control Tested on the Erie. Ry. Signal Engr., vol. 15, no. 2, Feb. 1922, pp. 65-66, 2 figs. Describes nine tests made on Erie R. R., all of which were satisfactory.

Avoidable Waste. Avoidable Waste in Car and Locomotive Operation, William Elmer. Mech. Eng., vol. 44, no 2, Feb. 1922, pp. 93-97, 2 figs. Outlines procedure for determining whether engines are properly loaded and used. Includes several appendices, one of which gives method of working out most economical tonnage for loading freight engines of any division, based on actual practicable performance in everyday operation. Discusses avoidable waste in operation of cars under three heads: (1) Their utilization in hands of agents, shippers and consignees; (2) handling and dispatchment in yards and on road; and (3) repair and inspection.

RAILWAY SHOPS

Can. Pac., Montreal. A Railroad Shop Organized for Efficiency. Machy. (Lond.), vol. 19, nos. 487 and 488, Jan. 26 and Feb. 2, 1922, pp. 502-504 and 535-537, 8 figs. Describes Angus Shops of Can. Pacific Ry. Co., Montreal, Canada. Jan. 26: General arrangement. Feb. 2: Designs of jigs and fixtures used: outlines some methods that have made it possible to reduce costs.

Machining Operations, Cost of. What is Wrong with the Railroad Shops, Edward K. Hammond. Machy. (N.Y.),vol. 28, no. 7, Mar. 1922, pp. 557-560. Investigation into relative costs of performing machining operations in seven representative railroad shops.

RAILWAY SIGNALING

Automatic-Block. Automatic Block Signaling, J. E. Saunders. Armour Engr., vol. 13, no. 2, Jan. 1922, pp 71-85, 8 figs. Economy of automatic signals; manual versus automatic block; train operation by signal indication; elements of automatic block signaling.

Color-Light. Color Light Signals Ry. Engr., vol. 43, no. 505, Feb. 1922, pp. 65-66 and 74. Report of committee on Light Signals appointed by Minister of Transport. Advocates this type of signal, a color-light type with separate lenses for each color indication.

Federal Audible Signal. The Federal Signal Company's Audible Signal. Ry. Age, vol. 72, no. 9, Mar. 4, 1922, pp. 516-518, 4 figs. Describes experiments on Boston & Albany in Mass. and New York. An audible warning slunded in conjunction with visual indication given by three-position automatic semaphore.

Locking Arrangement. Locking Arrangement for Movable Point Crossing Frogs, F. Parsons. Ry. Signal Engr., vol. 15, no. 2, Feb. 1922, pp. 63-64, 4 figs. Describes system installed on Central of Argentine which insures safety with minimum apparatus. Read before Inst. Ry. Signal Engrs.

Phase Shifter for A. C. Circuits. A Phase Shifter for Adjusting A. C. Track Circuits, W. F. Price. Ry. Signal Engr., vol. 15, no. 2, Feb. 1922, pp. 61-62, 8 figs. Discusses lag of current in wet and dry weather and describes a phase shifter which works equally well on double element vane or galvanometer relays.

Three-Position, Belgium. Weissenbruch Three-Position Signal System as Used in Belgium, T. S. Lascelles. Ry. Signal Engr., vol. 15, no. 2, Feb. 1922, pp. 55-58, 6 figs. Four indications given, clear, caution, attention or stop. Illustrations of the various positions.

RAILWAY STATIONS

Train Indicator Time-Tables. Train Indicator Time-Tables at Railway Stations. Ry. Gaz., vol. 36, no. 5, Feb. 3, 1922, pp. 177-179, 3 figs. Describes Benn & Cronin train indicator time-table.

RAILWAY TIES

Creosoting Timber Bridges and. Creosoting Timber on the Santa Fe Railway System, A. F. Robinson. West. Soc. Engrs. Jl., vol. 27, no. 3, Mar. 1922, pp. 84-90 and (discussion) pp. 90-96. Deals with creosoting timber bridges and track ties.

See also Ry. Maintenance Engr., vol. 18, no. 2, Feb. 1922, pp. 44-46, 1 fig. (Abstract.)

RAILWAY TRACK

Ballast. Report of Committee II—On Ballast. Am. Ry. Eng. Assn. Bul. vol. 23, no. 239, Sept. 1921, pp. 131-158, 6 figs. Application of ballast; ballast tools; specifications for ballast shovels.

Frogs, Reclaiming. Philadelphia & Reading Reclaims Frogs by Unique Methods. Ry. Maintenance Engr., vol. 18, no. 1, Jan. 1922, pp. 13-14, 8 figs. Describes system which it is claimed, is attended with very satisfactory results. Both plain and hard center equipment is repaired.

Maintenance. Track Maintenance by Contract on the Canadian Pacific Ry., H. G. Harton. Eng. News-Rec., vol. 88, no. 10, Mar. 9, 1922, pp. 399-401. Successful results of three years on 400 miles.

Plant Sidings. Trackage for Industrial Plants, Fred F. Hartford. Indus. Management, vol. 63, no. 3, Mar. 1922, pp. 151-154, 5 figs. Factors underlying their profitable installation.

Snow Fences. Snow Fence Design and Location. Elec. Traction, vol. 18, no. 2, Feb. 1922, pp. 144-146, 4 figs. Describes types successfully used by Chicago, North Shore and Milwaukee R. R. ,Rochester & Syracuse R. R., and Quebec Railway, Light, Heat & Power Co.

RAILWAYS

Cost of Transportation. On the Question of Net Cost; Rates (All Countries except America), Henry Gréard. Int. Ry. Assn. Bul., vol. 4, no. 2, Feb. 1922, pp. 331-345. Determination of net cost of carriage (passengers and goods), taking capital charges into consideration. Its relation to rates charged.

Reconstruction, France. Rebuilding Railway Structures in Northern France, M. Pellarin. Eng. News-Rec., vol. 88, no. 10, Mar. 9, 1922, pp. 397-398, 3 figs. Unique operations employed to save as much of damaged structures as possible. Work on Nord and Est railways cited. Translated from Revue Générale des Chemins de fer.

Tests Department, New Haven, R. R. The Department of Tests of the New Haven Railroad, H. P. Hass. New England R. R. Club, Jan. 10, 1922, pp. 235-248 and (discussion) 248-272. Discusses objects of the department, which are, principally, safety and economy of operation, methods used to obtain proper product being, through use of specifications and through use of tested product sheets. Details of the five divisions of department.

REFRACTORIES

American Practice. Notes on American Practice in Refractories, W. J. Rees. Ceramic Soc. Trans., vol. 21, part 1, Session 1921-22, pp. 69-84 and (discussion) 84-88, 19 figs. Outstanding feature of American practice is well-developed organization of plant for maximum production with minimum costs.

Resistance Tests. Resistance Tests on Refractory Products under Load at Different Temperatures, V. Bodin. Ceramic Soc. Trans., vol. 21, Part 1, Session 1921-22, pp. 56-65, 8 figs. Discusses investigations to find method of determining directly crushing strength at different temperatures, and their results. In French, pp. 44-45.

Thermal Conductivity. On the Determination of the Thermal Conductivity, Specific Heat, Density and Thermal Expansion of Different Rocks and Refractory Materials, Yoshiaki Tadokoro. Tohoku Imperial University Sci. Reports, vol. 10, no. 5, Dec. 1921, pp. 339-410, 42 figs. partly on supp. plates. Account of investigation begun four years ago in research laboratory of Imperial Steel Works, Yawata

REFRIGERATING PLANTS

Condenser Cooling-Water Diagram. Cooling Water for Ammonia Condenser, Alex H. Luedicke. Power, vol. 55, no. 8, Feb. 21, 1922, p. 302, 1 fig. Explains easy way to find amount of water required.

Corrosion in Systems. Control of Corrosion in Refrigerating Systems, F. N. Speller. A.S.R.E. Jl., vol. 8, no. 3, Nov. 1921, pp. 216-221 and (discussion) 221-224. Reviews what has been done and discusses possible application of these principles. Methods of protection are divided into two classes, viz.: by rendering water slightly alkaline, usually done by use of lime; and by eliminating free oxygen from solution.

REFRIGERATION

Brine Freezing of Fish. Brine Freezing of Fish, Harden F. Taylor. Refrig. World, vol. 57, no. 1, Jan. 1922, pp. 21-24. Refrigeration promises only solution of problem of distributing fish from sea to distant consumers in first-class condition. Describes brine freezing process. Brine-frozen versus air-frozen fish.

RESEARCH

Mechanical Engineering Advisory Committee. Mechanical Engineering Advisory Committee for Division of Engineering, Alfred D. Finn. Mech. Eng., vol. 44, no. 2, Feb. 1922, pp. 115-116. Describes contemplated program of committee formed within organization of Am. Soc. of Mech. Engrs.

Problems. Research Problems Discussed. Mech. Eng., vol. 44, no. 2, Feb. 1922, pp. 117-118. Discussion of papers by F. A. Wardenburg and A. D. Flinn. Report of A.S.M.E. work in lubrication, by Albert Kingsbury. Progress in steam-table research described.

RESERVOIRS

Waterproofing. Waterproofing a Leaky Reservoir at Nashville, Tenn. Eng. News-Rec., vol. 88, no. 8, Feb. 23, 1922, pp. 310-312, 5 figs. Leakage through masonry walls and old concrete floor necessitated extensive repair and watertight lining.

ROADS, CONCRETE

Construction Mistakes. Six Construction Mistakes in One Concrete Road, George L. Smith. Eng. News-Rec., vol. 88, no. 9, Mar. 2, 1922, pp. 357-358, 3 figs. Experience in building 20-ft. concrete military road disclosed number of errors which carry lessons.

ROLLING MILLS

Engines, Combination Gas and Steam. Development of Rolling Mill Engines, F. J. Denk. Blast Furnace & Steel Plant, vol. 10, no. 2, Feb. 1922, pp. 153-154. Advantages of combination of gas engine with steam engine.

Tables. Roller Bearings Mill Tables, J. M. Kelly. Blast Furnace & Steel Plant, vol. 10, no. 2, Feb. 1922, pp. 139-141, 2 figs. Describes new rolling mill tables in which were installed flexible roller bearings.

RUBBER

Thermal Insulation. Thermal Insulation of Rubber. Rubber Age, vol. 2, no. 12 Feb. 1922, p. 590, Discusses report by Food Investigation Board of experiments made with onazote.

Vulcanized. Determination of True Free Sulfur and True Coefficient of Vulcanization in Vulcanized Rubber, W. J. Kelly. Jl. Indus. & Eng. Chem. vol. 14, no. 3, Mar. 1922, pp. 196-197. Describes methods of analysis by means of which a more complete study of distribution of sulphur between the various ingredients of rubber compound can be made.

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SCIENTIFIC MANAGEMENT

See Industrial Management.

SEWAGE DISPOSAL

Acid Process. The Miles Acid Process of Sewage Treatment, F. W. Mohlman. Engr.'s Soc. West. Pa. Proc., vol. 37, no. 7, Oct. 1921, pp. 345-364 and (discussion) pp. 365-374, 1 fig. Notes on theory and experimental work on Miles acid process; economic difficulties, and limitations and possibilities. Bibliography.

Colloids in Treatment. Colloid Chemistry and Its Relation to Tank Treatment of Sewage, F. W. Mohlman and Langdon Pearse. Am. Water Works Assn. Jl., vol. 9, no. 2, Mar. 1922, pp. 311-318, 1 fig. It is claimed that as yet in removal of colloids by tank treatment, but little has been accomplished in a practical way by settling alone, or by use of colloidors; use of acids, instead of alkaline precipitants, yields a well clarified effluent, but has not proved applicable except under special conditions. Additional tests and investigations are needed.

Sludge Characteristics. Characteristics of Some Connecticut Sludges, J. Frederick Jackson and Joseph Doman. Boston Soc. Civ. Engrs. Jl., vol. 9, no. 2, Feb. 1922, pp. 37-58, 4 figs. In general it was found that where area is available, air drying and final disposal on spoil land is simplest and most economical method of handling sludges from plain sedimentation, Imhoff tanks, secondary sedimentation tanks and perhaps lime treatment. Wet screenings, when applied to land for fertilizing purposes, gave surprisingly good results. Where a great degree of purification is required, activated sludge or Imhoff sprinkling filter system should be selected.

SHAFTS

Torsional Vibrations. Torsional Vibrations of Shafts (Verdrehungsschwingungen von Wellen), O. Föppl. Schweizerische Bauzeitung, vol. 79, no. 5, Feb. 4, 1922, pp. 56-59, 11 figs. Demonstrates practical applicability of theoretical determination of coefficients of natural vibration of shafts with rotating masses.

SHEARS

Pressure Required for Shearing. Formulas for Pressure Required for Shearing Metal, D. C. Oviatt. Machy. (N. Y.), vol. 28, no. 7, Mar. 1922, p. 528, 1 fig. Presents formulas for shear calculation and explains application.

SHERARDIZING

Experiments. Experiments with Sherardizing, Leon McCulloch. Min. & Metallurgy, no. 182, Feb. 1922, p. 63. Study of effect of iron in zinc dust on sherardizing process and on resulting coatings, giving evidence that no part of a sherardizing coating can contain less than 6 per cent iron. (Abstract.)

SHOVELS

Electric. New Types of Small Electric Shovels. Eng. & Contracting, vol. 57, no. 7, Feb. 15, 1922, pp. 163-164. Describes three new types of small revolving electric shovels developed by Marion Steam Shovel Co., Marion, Ohio, designed for work on street or road construction, in quarries, open mines, lumber reclamation work, etc.

SINE BARS

Uses. The Use of the Sine Bar. Machy. (Lond.), vol. 19, no. 488, Feb. 2, 1922, pp. 529-531, 6 figs. Gives some examples of wide range of angle work covered by it. Is more adaptable than the protractor.

SPRINGS

Handling and Heat-Treating. Methods of Handling and Heat-Treating Springs. Can. Machy., vol. 27, no. 8, Feb. 23, 1922, pp. 21-25, 23 figs. Principles governing uniform heating and cooling; type and arrangement of equipment; stationary and continuous furnaces; utilizing heat in waste gases.

Impact Absorption. Graphic Representation of Absorption of Impact by Springs, Leslie H. Mann. Machy. (N. Y.), vol. 28, no. 7, Mar. 1922, pp. 554-555, 2 figs. Determination of energy absorbed by spring under load based upon assumption that body producing deflection of spring is moving with its center of gravity in line with axis of spring, or in line with point that will cause spring to act most efficiently.

STANDARDIZATION

Advantages. Significance of Standardization to American Industry and the Federal Government. A. A. Stevenson. Mech. Eng., vol. 44, no. 3, Mar. 1922, pp. 185-186 and 203. Advantages of standardization to all, including Government should cooperate with industry. What is being done by Am. Eng. Standards Committee.

Waste Elimination through. Waste Elimination Through Standardization, H. Campbell and Alex. Taub. Am. Mach., vol. 56, no. 10, Mar. 9, 1922, pp. 363-364. Reducing manufacturing costs. How standardization benefits both manufacturer and consumer. Introduction of universal numbering system. Multiplying service by six.

STEAM

Ruth Storage System. The Ruths Steam Accumulators (L'accumulatore di vapore Ruths), E. C. Constam-Gull. Industria, vol. 35, no. 24, Dec. 31, 1921, pp. 521-527, 17 figs. Various examples of application of this system of equalizing pressure loads; savings effected in fuel

STEAM GENERATORS

Electrically Operated. Generation of Steam by Electricity, E. T. Kaelin. Eng. Jl. (Eng. Inst. Can.), vol. 5, no. 3, Mar. 1922, pp. 127-133, 7 figs. Field of use for electric-steam generator, its advantages to consumer from load-factor point of view and to electric supply compapy as outlet for surplus power. Discusses types of electric-steam generators with particular reference to water-resistance type.

STEAM POWER PLANTS

Oil-Burning. Operation of Oil-Burning Steam Plants, C. H. Delany. Iron Age, vol. 109, no. 8, Feb. 23, 1922, pp. 525-527, 4 figs. Discussion of plant characteristic diagram, with particulars regarding its use in establishment of as tandard of performance and in increasing plant efficiency. (Abstract.) Paper presented at joint meeting of Am. Soc. Mech. Engrs. and Am. Inst. Elec. Engrs.

STEAM SHOVELS

Operations. Steam-Shovel Operation by Phelps Dodge Corporation, H. M. Ziesemer and George Mieyr. Min. & Metallurgy, no. 182, Feb. 1922, pp. 44-45. Discusses methods and cost, with brief description of equipment used in operation. (Abstract.)

STEAM TURBINES

Efficiency Tests of 60,000-Kw. Efficiency Tests of a 60,000-Kw. Turbine, Herbert B. Reynolds and Walter F. Hovey. Power, vol. 55, no. 11, Mar. 14, 1922, pp. 411-413, 4 figs. Results of tests on turbine installed in power station of Interborough Rapid Transit Co. (Abstract.) Paper to be read before Am. Soc. Mech. Engrs.

STEEL

Alloy. *See Alloy Steels.*

Basset Direct-Production Process. Direct Production of Steel (La production directe de l'acier), E.-H. Weiss. Nature, no. 2491, Dec. 31, 1921, pp. 423-427, 5 figs. Describes Basset process as applied at Dennemont Works, or producing steel direct from ore.

Cracking. Intercrystalline Cracking of Mild Steel in Salt Solutions, J. A. Jones. Faraday Soc. Trans., vol. 17, part 1, no. 49, Dec. 1921, pp. 102-109, 9 figs. Describes action of various solutions in producing cracking of steel in state of stress.

Failure on Hardening. The Mechanism of the Failure of Steel upon and after Hardening. G. W. Green. Faraday Soc. Trans., vol. 17, part 1, no. 49, Dec. 1921, pp. 139-145, 7 figs. Outlines causes of stressing and subsequent failure.

Fatigue Tests. Endurance of Steel Under Repeated Stresses, D. J. McAdam, Jr. Chem. & Met. Eng., vol. 25, no. 24, Dec. 14, 1921, pp. 1081-1087, 22 figs. Fatigue tests on many commercial and alloy steels develop no evidence of "endurance limit," ultimate tensile strength closely related to endurance stress at 1,000,000,000 cycles; special White-Souther machine and semi-logarithmic graphs used.

Identification and Storage. A New Idea in Steel Identification and Storage. Ry. & Locomotive Eng., vol. 35, no. 2, Feb. 1922, pp. 44-45, 2 figs. Describes method of marking steel bars for identification, and also designing and constructing suitable steel storage racks, employed by Gould & Eberhardt, Newark, N. J.

Literature, 1921. Review of Iron and Steel Literature for 1921, E. H. McClelland. Blast Furnace & Steel Plant, vol. 10, no. 1, Jan. 1922, pp. 4-8. Classified list of the more important books, serials and trade publications during year, with a few of earlier date, not previously announced. Also in Forging and Heat Treating, vol. 8, no. 1, Jan. 1922, pp. 4-8.

Phosphorous, Influence of. Influence of Phosphorous upon the Microstructure and Hardness of Low-Carbon, Open-Hearth Steels, Edward C. Groesbeck, U. S. Bur. of Standards Technologic Papers, no. 203, Nov. 21, 1921, pp. 1-33, 15 figs. Two series of specimens, one of basic and the other of acid open-hearth steel, with phosphorus content in each series varied in four or five steps within limits 0.008 to 0.115 per cent, which mark the ordinary limits of phosphorus content in plain carbon steel, were employed in study of relationship between phosphorus content and microstructure and hardness resulting from series of different heat treatments tried.

Properties in Hardening Range. Properties of Some Steels in the Hardening Range, W. R. Chapin. Am. Soc. for Steel Treating Trans., vol. 2, no. 6, Mar. 1922, pp. 507-514 and (discussion by Zay Jeffries) pp. 514-515, 4 figs. Report [illegible] which when properly quenched, harden throughout mass, and are martensitic when so hardened.

Wire, Low-Carbon Steel. Ghost Lines and Grain Elongations in Hot Rolled and Cold Drawn Low Carbon Steel Wire, N. B. Hoffman. Am. Soc. for Steel Treating Trans., vol. 2, no. 6, Mar. 1922, pp. 516-523 and (discussion) pp. 523-[illegible] Shows [illegible] between ghost lines, bands, and elongated grain structures as found in low-carbon steel wire.

STEEL CASTINGS

Heat Treatment. The Heat Treatment of Steel Castings, Walter H. White. Am. Soc. for Steel Treating Trans., vol. 2, no. 5, Feb. 1922, pp. 437-440. Suggestions for obtaining good results.

STEEL, HEAT TREATMENT OF

Alloy Carbonizing Boxes. Do Alloy Carbonizing Boxes Pay? C. M. Campbell. Am. Soc. for Steel Treating Trans., vol. 2, no. 6, Mar. 1922, pp. 495-499. Considers factors governing life and performance of carbonizing boxes, and reasons why they should not be placed on supply account instead of becoming part of equipment.

Brinell Hardness, Calculating. New Development on the Influence of Mass in Heat Treatment, E. J. Janitzky. Am. Soc. for Steel Treating Trans., vol. 2, no. 5, Feb. 1922, pp. 377-383, 2 figs. Also Iron Age, vol. 109, no. 10, Mar. 9, 1922, pp. 658-659, 2 figs. Suggested formula for calculating Brinell hardness from given data. Applicable to alloy and carbon steels. Paper presented at N.Y. Section of Am. Soc. for Steel Treating.

Carbon Steel. Effect of Heat Treatment on the Mechanical Properties of 1 Per Cent Carbon Steel, H. J. French and W. George Johnson. U. S. Bur. of Standards Technologic Papers, no. 206, Dec. 27, 1921, pp. 93-121, 16 figs. Study of effects of varying time-temperature relations in heat treatment on tensile and impact properties, hardness, and structure of 1 per cent carbon steel, including (a) effect of temperature variations in hardening (b) time at hardening temperatures both above Acm and between the Ac1 and Acm transformations. (c) effects of tempering steel hardened in different ways and effects of "soaking" just under lower critical range, (d) comparison of oil and water hardening for production of definite strengths.

Effect of Heat Treatment on the Mechanical Properties of One Per Cent Carbon Steel, H. J. French and W. George Johnson. Am. Soc. for Steel Treating Trans., vol. 2, no. 6, Mar. 1922, pp. 467-494, 16 figs. Results of tests show that most suitable oil or water quenching temperature for steel which is subsequently to be tempered at relatively high temperatures is slightly above end of Ac_1 transformation.

Cold-Heated Bolts. Cold-Heated Bolts—Their Metallography and Heat Treatment, W. E. Hillman. Am. Soc. for Steel Treating Trans., vol. 2, no. 5, Feb. 1922, pp. 369-376, 20 figs.; also Iron Trade Rev., vol. 70, no. 8, Feb. 23, 1922, pp. 538-541, 18 figs. Various degrees of distortion may be found in same bolt; however, annealing at 1150 deg. Fahr. will remove weakening effect of cold work. Annealing above critical range is preferable.

Fixtures for. Special Fixtures for Heat Treating, E. H. Tingley. Forging & Heat Treating, vol. 8, no. 2, Feb. 1922, pp. 96-99, 7 figs. Describes a number of appliances for heating and quenching small parts as developed form suggestions made by workmen of Delco-Light Co. heat-treating department.

Structural Changes due to Heating Medium. Influence of the Heating Medium on the Structural Changes in Steel, A. E. Bellis. Am. Soc. for Steel Treating Trans., vol. 2, no. 5, Feb. 1922, pp. 398-401 and (discussion) pp. 401-402. Analysis for structural changes as they are influenced by heating and cooling medium.

STEEL PLANTS

Pressed Steel. Description of a Pressed Steel Plant. Blast Furnace & Steel Plant, vol. 10, no. 2, Feb. 1922, pp. 144-147, 4 figs. Brief history of reorganization of Sharon Pressed Steel Co., Sharon, Pa., equipped to manufacture and assemble heavy pressed-steel products. Routing and handling.

STOKERS

Motion Pictures of Operation. Motion Pictures of a Stoker Furnace in Operation, R. Sanford Riley, Mech. Eng., vol. 44, no. 2, Feb. 1922, pp. 103-104, 4 figs. Describes invention of F. H. Daniels and pictures taken at plant of Bird & Son, Inc., East Walpole, Mass., showing operation of a 9-retort extra long Riley underfeed stoker.

STORAGE BATTERIES

Overhauling. Overhauling Storage Batteries, Chester Schenck. Power, vol. 55, no. 9, Feb. 28, 1922, pp. 336-339, 5 figs. Symptons that give warning of need of overhauling. Preparation for work with explicit directions covering two methods of procedure, one to be used when work may be carried along to completion, and other where interruption is probable.

STREET RAILWAYS

Cars, One-Man. One-Man Car Operation with Double-Truck Cars, H. S. Sweet Elec. Ry. Jl., vol. 59, no. 4, Jan. 28, 1922, pp. 156-158, 9 figs. Describes new one-man car in Utica equipped with turnstiles to admit passengers who pay as they leave. (Abstract.) Paper read before N. Y. Elec. Ry. Assn.

Two New Types of Safety Cars for Chicago, Charles Gordon. Elec. Ry Jl., vol. 59, no. 2, Jan. 14, 1922, pp. 65-71, 14 figs. Describes single-truck and double-truck one-man safety cars, both arranged for double-end operation with separate entrance and exit passageways.

STRESSES

Flat Cylinder Heads. Stresses and Deformations in Flat Circular Cylinder Heads, Gilbert Dudley Fish. Mech. Eng., vol. 44, no. 3, Mar. 1922, pp. 165-169 and (discussion) p. 170, 12 figs. Analysis covering [illegible] elastic disks, where form and loading are symmetrical with respect to [illegible] centers, where loading is combination of fluid pressures and of forces acting normally on concentric circles, where thickness is uniform, and where all stresses are within limits of true elasticity. Formulas applicable to all cases considered are developed, and equations are given for constants of integration involved in mathematical analysis.

Thermal. The Thermal Stresses in Spherical Shells Concentrically Heated, Charles H. Lees. Roy. Soc. Proc., vol. 100, no. A 705, Jan. 2, 1922, pp. 379-394, 7 figs. Discusses stresses set up in materials by difference in temperature and its application to blast furnaces and others.

STRUCTURAL STEEL

Tensile Properties. Tensile Properties of Some Structural Alloy Steels at High Temperatures, H. J. French. Am. Soc. for Steel Treating Trans., vol. 2, no. 5, Feb. 1922, pp. 409-422, 8 figs. Account of tests conducted by Bur. of Standards to determine tensile properties of a number of structural alloy steels throughout temperature range of 20 to 550 deg. cent.

STRUCTURES

Steel, Design of. Reminders for the Designer of Steel Structures, R. Fleming. Eng. News-Rec., vol. 88, no. 7, Feb. 16, 1922, pp. 271-273, 4 figs. Cautions as to corrosion, expansion effects, future extension and rough handling.

SUBSTATIONS

Automatic Railway. Automatic Railway Substation Economies, H. G. Hecker. Elec. Traction, vol. 18, no. 2, Feb. 1922, pp. 148-152, 4 figs. Savings resulting from installation of automatic substation equipment. Typical analyses of interurban and city systems.

SUBWAYS

Extension, Paris. The Metropolitan of Paris (Le chemin de fer Métropolitain de Paris), L. Biette. Génie Civil, vol. 80, no. 5, Feb. 4, 1922, pp. 97-103, 20 figs. partly on supp. plate. Describes work in connection with extension of line, including tunnel work.

SURVEYING

Aerial Photography. Winged Surveyors, Sherman M. Fairchild. Sci. Am., vol. 126, no. 3, Mar. 1921, pp. 157-160 and 219, 8 figs. What aerial photography is doing for industry and science.

Cadastral Resurveys. A Review of Important Developments in the Science of Cadastral Resurveys as Executed by the United States Government, with Ethical Discussion Thereof. Am. Soc. Civ. Engrs, Proc., vol. 48, no. 2, Feb. 1922, pp. 369-372. Discussion by W. J. Lightfoot, Clay Tallman and S. V. Proudfit of paper by Howard Richards Farnsworth.

SWAGING

Hot. Hot Swaging, Fred R. Daniels. Machy. (N. Y.), vol. 28, no. 7, Mar. 1922, pp. 521-526, 10 figs. Describes swaging operations, based on practice and recommendations of the Langelier Mfg. Co., Providence, L. I.

T

TELEPHONY

Automatic. Auxiliary Features in Automatic Telephone Systems, W. Aitken. Electrician, vol. 88, no. 2282, Feb. 10, 1922, p. 154, 1 fig. Describes an impulse converter used in Relay Automatic Telephone Co.'s system, which responds to dial, or other impulses, and builds up a circuit to energise a relay associated with called line to complete a connection.

Line Construction. Telephone Line Work in the United States, E. S. Byng. Instn. Elec. Engrs Jl., vol. 60, no. 305, Jan. 1922, pp. 85-110 and (discussion) 110-135, 34 figs. Discusses American practice in line construction work. Notes on pole routes, aerial cables, conduit routes, underground cables, house cabling, block cabling and wiring, drop wiring.

TEMPERATURE CONTROL

Automatic Valve. Temperature Regulation by Automatic Valve, G. A. Wegner. A.S.R.E. Jl., vol. 8, no. 3, Nov. 1921, pp. 203-210, 6 figs. Discusses control of a valve through which vapor pressure is made controlling factor, the object being to assist man in charge in his task and to make desired results more certain.

TEXTILE INDUSTRY

Science in. Science in the Textile Industry. Mech. Eng., vol. 44, no. 3, Mar. 1922, pp. 181-184, 1 fig. Two papers presented before Textile Division of A.S.M.E., Hidden Wastes in Textile Plants, Thayer P. Gates; and Economy in Textile Drying, B. R. Andrews. Discussion.

TIDAL POWER

Utilization. Using Sea Power (Utilisons la "Houille Bleue"), H. Lémonon. La Nature, nos. 2482 and 2484, Oct. 29 and Nov. 12, 1921, pp. 278-283 and 310-316, 19 figs. Oct. 29: Describes systems of tidal power production by Reynolds, Tommasi, Legrand, Praceiq, etc. Nov. 12: Describes systems depending on use of turbines and hydraulic accumulators.

TIMBER

Conservation of Supply. Conservation of Timber Supply. Mech. Eng., vol. 44, no. 3, Mar. 1922, pp. 162-164. Reforestation to Conserve Industrial Investments, by David L. Goodwillie; and Paper and By-Products from Southern Pine Refuse, by Joseph H. Wallace.

Creosoted. Experiences of Santa Fe Ry. with Creosoted Timber, A. F. Robinson. Eng. & Contracting, vol. 57, no. 8, Feb. 22, 1922, pp. 176-177. Notes on piling troubles and the remedies; air seasoning of untreated sleepers; field treatment of piles; rules for handling treated timber. (Abstract.) Paper presented before joint meeting of West. Soc. Engrs. and Am. Wood Preservers' Assn.

TIME STUDY

Bedaux Human Power Measurement. The Bedaux Principle of Human Power Measurement, L. C. Morrow. Am. Mach., vol. 56, no. 7, Feb. 16, 1922, pp. 241-245. Describes system practised by Chas. E. Bedaux Co., Cleveland, Ohio. Application to compensation of labor. Isolation from methods, equipment and piece rates. Simplicity of records.

Motion Study and. Time and Motion Study, Eric Farmer. Eng. & Indus. Management, vol. 7, nos. 3, 4, 5, 8, Jan. 19, 26, Feb. 2, 23, 1922, pp. 70-75, 95-98, 136-139, 221-223. Jan. 19: Review of past works by Taylor and Gilbreth. Jan. 26: New point of view in undertaking time and motion study; reducing unproductive labor. Feb. 2: Correct definition of motion study. Feb. 23: Time study.

TRACTORS

Caterpillar. A New Caterpillar Development, F. Rowlinson. Sci. Am., vol. 126, no. 3, Mar. 1922, pp. 194-195, 8 figs. British efforts to save power and increase speed by means of a track that will yield to local obstacles. Describes new type of caterpillar suspension and its application.

Four-Wheel Drive. A Four-Wheel Drive Tractor from the Pacific Coast. Automotive Industries, vol. 46, no. 10, Mar. 9, 1922, pp. 554-555, 4 figs. Describes the Wizard 4-Pull tractor which transmits power to all four wheels by roller chains and steers by disconnecting power from wheels on one side.

Road-Rail Trucks and. The Stronach Dutton System of Road Rail Traction. Roy. Engrs. Jl., vol. 35, no. 2, Feb. 1922, pp. 93-96, 2 figs. on supp. plates. Principle adopted is to support front axle of a short-wheel base tractor by a four-wheeled bogie running on a Decauville line. A drawbar is carried from bogie pivot to back of tractor for attachment of such trucks as can be hauled. Most recent pattern of tractor hauling train and converting from road to rail or rail to road traction.

Samson. Cooling Capacity Increased in Samson Tractor, P. M. Heldt. Automotive Industries, vol. 46, no. 9, Mar. 2, 1922, pp. 502-505, 4 figs. Technical description. Improvements in lubricating and cooling systems; enlarging of radiator and fan; etc.

Types. Tractor Show Marked by New Designs, P. M. Heldt. Automotive Industries vol. 46, no. 8, Feb. 23, 1922, pp. 451-457, 8 figs. Creeper tractor construction; road-building and maintenance tractors; corn-belt and grain-belt tractor requirements contrasted; new machines and parts described.

TRANSPORTATION

Highway. Highway Transportation. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 2, Feb. 1922, pp. 318-358. Symposium containing following papers: Highway Transportation, Thomas H. MacDonald. Inspection of Highway Construction William G. B. Thompson. Financing and Bonding Highways, John N. Cole. Highway Bonding from the Viewpoint of the Surety Company, E. A. St. John. Financing and Bonding Highway Work, Edward C. Lunt. The Motor Vehicle in Highway Financing, Harry Meixell. The Motor Truck as an Asset to Railroad Operation, R. S. Parsons. Motor Vehicle Control, G. Wythe Munford. Discussion, W. K. Hatt.

Railway. Railroad Transportation Am. Soc Civ. Engrs. Proc, vol. 48, no. 2, Feb. 1922, pp. 288-316. Symposium containing following papers: Railroad Transportation, Howard Elliott. Railroads and Their Employees, W. N. Doak. Railroad Transportation and Owners of Railroad Securities, F. A. Molitor. Discussion, George W. Simmons.

Water. Water Transportation, Am. Soc. Civ. Engrs. Proc., vol. 48, no. 2, Feb. 1922, pp. 266-286. Symposium containing following papers: Water Transportation, R. H. M. Robinson. The American Merchant Marine, Winthrop L. Marvin. The Merchant Marine Problem, Emory R. Johnson, Water Transportation in its Relation to the Railways, Samuel O. Dunn.

TUNNELS

Rock Driving. Driving a Five-Mile Rock Tunnel for Japan Railway. Eng. News-Rec., vol. 88, no. 10, Mar. 9, 1922, pp. 394-397, 7 figs. Tunnel is being driven mainly on the bottom-heading systen, but with the widening operated in two different ways. A side-heading system will be employed when nature of rock makes this advisable.

Second Simplon. Completing the Second Simplon Tunnel (L'achevement du deuxième tunnel du Simplon). Bul. Technique de la Suisse Romande, vol. 48, no. 2, Jan. 21, 1922, pp. 13-16, 6 figs. partly on supp. plate. Tunneling work, supporting work, and facing for good and poor rock, and difficulties encountered.

Ventilation. Research Settles the Problem of Tunnel Ventilation, Robert C. Skerrett. Sci. Am., vol. 126, no. 3, Mar. 1922, pp. 169-170, 4 figs. Determination of best system for supplying fresh air to Hudson River vehicular tunnel tube.

V

VALVES

Gate, Electrically Operated Tests on Motor-Operated Gate Valves for High-Pressure Steam, T. W. Stinson. Power, vol. 55, no. 7, Feb. 14, 1922, pp. 263-265, 5 figs. Emergency-closing tests made on five motor-operated 6-in to 10-in. gate valves, against steam at 225 lb. pressure and 150 deg. Fahr. superheat blowing to atmosphere.

VENTILATION

Effect of CO in Air. The Physiological Principles Governing Ventilation When the Air is Contaminated with Carbon Monoxide, Yandell Henderson and Howard W. Haggard. Jl. Indus. & Eng. Chem., vol. 14, no. 3, Mar. 1922, pp. 229-236, 5 figs. (Abstract.) Report to Chief Engineer of New York & New Jersey Tunnel Commissions.

VENTURI METERS

Air and Gas Measurement. The Metering of Large Volumes of Air and Gas By Means of the Venturi Tube, John L. Hodgson. Instn. Min. Engrs. Trans., vol. 62, Part 3, Jan. 1922, pp. 208-218 and (discussion) 218-220, 9 figs. Account of application of Venturi meter.

VISCOSIMETERS

Conversion Chart. Viscosimeter Conversion Chart, Power, vol. 55, no. 10, Mar. 7, 1922, p. 377, 1 fig. Presents chart for finding viscosity reading of a particular oil on any of standard viscosimeters when its reading on one of viscosimeters has been determined by experiment at same temperature.

VOCATIONAL TRAINING

Seasonal Industries. A Management Problem in Seasonal Industries, D. W. Rockey. Indus. Management, vol. 63, no. 2, Feb. 1922, pp. 77-79, 1 fig. Problem of seasonal industries is to efficiently teach large increases of working forces in minimum of time. Solution of problem is training of largest possible corps of instructors, both as to instructional methods and as to operating procedure and organization

W

WASTE

Causes and Reduction. A Campaign Which Cut Wastes in Half, Peter F. O'Shea, Factory, vol. 28, no. 3, Mar. 1922, p. 281. Tells how nearly 50 per cent of entire yearly waste bill was reduced by Dennison Mfg. Co. by a systematic following up of twelve causes of waste.

Engineering Industries. Waste in the Engineering Industries. Time Eng. Supp. Jan. 21, 1922, pp. 1-5. Views of representative manufacturers on accidental and deliberate waste, routine waste, waste of business, and deficient use of machinery.

WASTE HEAT

Utilization. The Utilization of Waste Heat From Electrical Generating Stations. F. H. Whysall. Practical Engr., vol. 65, no. 1823, Feb. 2, 1922, pp. 69-70. Possibility of locating industrial plants about generating stations to use waste heat, and difficulties arising. Paper read at joint meeting of Instn. Elec. Engrs. and Instn. Heat & Vent. Engrs.

WATER MAINS

Equipment for Constructing Distributing. Mechanical Aids for Distributing Work in Detroit, Michigan, W. Montgomery Mitchell. Am. Water Works Assn. Jl., vol. 9, no. 2, Mar. 1922, pp. 172-185, 8 figs. Lists and describes various types of equipment used in construction of distributing mains for Detroit water works.

WATER METERS

Capacity Tests. Determining by a Single Flow Test the Capacity of a Meter at All pressure Losses, Fred. B. Nelson. Am. Water Works Assn. Jl., vol. 9, no. 2, Mar. 1922, pp. 241-246, 3 figs. Writer describes method of plotting and points out its conveniences and advantages. Home-made apparatus used for test.

WATER PURIFICATION

Colloid Chemistry Applied to. Application of Colloid Chemistry to Study of filter Effluents, Malcolm Pirnie. Am. Water Works Assn. Jl., vol. 9, no. 2, Mar. 1922, pp. 247-273, 6 figs. Selected facts from applied colloid chemistry. Writer compares observed phenomena in water purification with those in colloid chemistry, and suggests explanations of former based on experimental proofs and reasonable assumptions developed in latter.

WATER SUPPLY

Hetch Hetchy, San Francisco. Construction Progress of the Hetch Hetchy Water Supply of San Francisco, California, M. M. O'Shaughnessy. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 2, Feb. 1922, pp. 147-173, 10 figs. Presents comprehensive view of present stage of construction, making only such reference to general scheme and matters of policy as appear necessary. General description of project; construction work completed and in progress; hetch hetchy railroad; lower Cherry power system; hetch hetchy dam; Lake Eleanor dam; aqueduct tunnel. Ecpenditures to present time total about $14,000,000.

Repairing Flood-Destroyed. Reparation of Vancouver's Flood-Destroyed Water System. Contract Rec., vol. 36, no. 8, Feb. 22, 1922, pp. 168-171, 5 figs. Describes methods of restoring intake works and mains, put out of commission by flood in October, 1921. New improvements planned as result of difficulties experienced.

WELDING

Cast Iron. *See Cast Iron, Welding without Studding.*

Frogs and Crossings. Welding Frogs and Crossings with Manganese Steel, H. R. Pennington. Eng. & Contracting, vol. 57, no. 7, Feb. 15, 1922, pp. 152-154, 2 figs. Qualities and methods of use in welding operations. Paper read before Am. Welding Soc.

See also Electric Welding; Electric Welding, Arc.; Oxy-Acetylene Welding.

WIND TUNNELS

Motor Regulator. Langley Field Wind Tunnel Motor Regulator, D. L. Bacon. Aviation, vol. 12, no. 8, Feb. 20, 1922, pp. 226-227, 1 fig. N.A.C.A. develops motor regulator which practically solves problem of constant propeller speed in wind tunnel. N.A.C.A. Technical Note No. 81.

Engineering Index

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A

ACCIDENT PREVENTION

METHODS AND LIMITATIONS. Limitations and New Methods of Accident Prevention (Grenzen und neue Wege der Unfallverhütung), Karl Hartmann. Zeit. des Vereines deutscher Ingenieure, vol. 66 no. 8, Feb. 25, 1922, pp. 186-188. Conditional and unconditional protection. Technical and economic limitations. Development of protective regulations. Necessity of co-operation between machine constructor, manager and workman.

AERIAL PHOTOGRAPHY

FAIRCHILD CAMERA. Aerial Photography, W. L. Hamilton. Aerial Age, vol. 15, nos. 1 and 2, Mar. 13 and 20, 1922, pp. 6-7 and 36-38, 7 figs. Mar. 13: Discusses a map of New York taken from an airplane, and the Fairchild camera with which it was made. Mar. 20: Discusses several examples of successful aerial photography.

AERONAUTICAL INSTRUMENTS

TELECOMPASS. A Solution of the Problem of Determining Position in an Airplane (Une solution du problème de l'orientation en avion). Industrie Electrique, vol. 31, no. 710, Jan. 25, 1922, pp. 15-27, 4 figs. Mechanical and electrical description of the telecompass, and its use.

AIR COMPRESSORS

MODERN. Modern Compressors (Les compresseurs modernes), A. Lambrette. Techinque Modern, vol, 13, nos 11 and 12, Nov. and Dec. 1921, and vol. 14. no. 2, Feb. 1922, pp. 468-474, 502-510 and 59-63, 48 figs. Discusses single-acting, double-acting, monocylindric-two-phase, two-stage, and multiple-stage compressors; inlet and outlet valves; lubrication; play in bearings and connecting rod; etc.

PORTABLE OIL-ENGINE-DRIVEN. A portable Air Compressor for Industrial Use (Groupe motocompresseur transportable pour usages industriels), J.-A. Calmettes. Génie Civil, vol. 80, no. 4 Jan. 28, 1922, pp. 87-88, 2 figs. Describes the Diatto compressor driven by an oil engine, for drilling, boring, etc.

AIR CONDITIONING

GAS-ABSORPTION DEVICE. A New Device for Gas Absorption, H. E. Robertson. Chem. Age (N. Y.), vol. 30, no. 2 Feb. 1922, pp. 59-60, 2 figs. Construction and operation of new air conditioner and purifier adapted to many industrial processes involving handling of gasses.

AIRCRAFT

DESIGNING PARTS. Improved Method for Designing Aircraft Parts, Roy G. Miller and F. E. Seiler, Jr. Aviation, vol. 12, no. 13, Mar. 27, 1922, pp. 366-367, 2 figs. Practical method for determination of elements of irregular structural sections.

FUELS. See [illegible]

RESEARCH. Research from the Designers' Constructors' and Users' Points of View, Fred M. Greeen. Flight, vol., 14, no. 8, Feb. 23, 1922, pp. 121-122. Discusses problems of wing surface, power required, metal construction, calculations of stresses, engine design, fuels, navigation, etc. (Abstract). Paper read before Air Conference, 1922. See also Aerial Age, vol. 15 nos. 1 and 2, Mai. 13 and 27, 1922, pp. 8-9 and 61-62.

SPECIALIZED. Specialized Aircraft, W. D. Beaty. Aeronautical Jl., vol. 26, no. 135, Mar. 1922, pp. 92-101 and (discussion) 101-107. How heavier-than-air aircraft has been developed in England on specialized lines, with special reference to comfort of passenger.

AIRPLANE ENGINES

DEVELOPMENTS. Recent Aircraft Engine Developments, C. Fayette Taylor. Soc. Automotive Engrs. Jl., vol. 10, no. 3, Mar. 1922, pp. 204-206, 5 figs. Outlines most important advances in aircraft engines since signing of armistice. Use of anti-knock compounds; aircraft-engine size and cooling; aircraft powerplant refinement.

AIRPLANES

ALTIMETER AND AIR SPEED INDICATOR. The Dugit Altimeter and Air Speed Indicator, J. H. Blakely. Aviation, vol. 12, no. 13, Mar. 27, 1922, pp. 371-372, 3 figs. Discusses instruments based on application of Archimedean spiral which give increased precision and uniform sensitiveness. Translated from Génie Civil.

FUEL LEVEL INDICATOR. The Smith Petrol Level Indicator. Flight, vol. 14, no. 8, Feb. 23 1922, p. 124, 2 figs. Describes new device by S. Smith & Sons Ltd., Lond., special features of which are simplicity both in construction and operation. Adaptable also for use on reservoirs, storage tanks, etc.

RESEARCH. Research With Full Sized Airplanes, F. H. Norton. Tech. Eng. News, vol. 2, no. 9, Mar. 1922, pp. 240-241, 3 figs. Describes some free flight problems recently investigated by Nat. Advisory Committee for Aeronautics, at Langley Field.

AIRSHIPS

DEVELOPMENT AND POSSIBILITIES. Airships, G. H. Scott. Aerial Age, vol. 14, no. 25, Feb. 27, 1922, pp. 590-593. Airship activities in various countries technical position of modern British airship, including hull, fabric, engines, safety, weather conditions, and mooring mast; value of airships for defense. Paper read before British Air Conference.

MODEL TESTS. Hydrostatic Test of an Airship Model. Nat. Advisory Committee for Aeronautics Technical Notes, no. 87, Mar, 1922, 15 pp., 8 figs. on supp. plates. Airship model made by Goodhear Rubber Co. was filled with water and suspended from beam and deformations of envelope studied under following conditions: both ballonets empty; forward ballonet filled with air; rear ballonet filled with air; and both ballonets filled with air.

R 38 ACCIDENT. British Report on the Loss of Airship R38. Aviation, vol, 12, no. 11, Mar. 13, 1922, pp. 311-312. Findings of Aeronautical Research Committee attribute accident to inaccurate calculations, faulty designs and structural weakness.

SPEED. The Choice of the Speed of an Airship, Max M. Munk. Nat. Advisory Committee for Aeronautics Techincal Notes, no. 89, Mar. 1922, 8 pp., 2 figs. Presents fairly simple rules which it is claimed may be of advantage if reasonable applied.

ALCOHOL

DILUTE SOLUTIONS. The Vapour Pressures of Dilute Alcohol Solutions, R. Thomas. Soc.Chem. Industry Jl.,vol. 41, no. 4, Feb. 28, 1922, pp. 33-34T, 2 figs. Describes rapid method of determining partial pressures of alcohol and water in an aqueous solution of former.

ALLOY STEELS

VIBRAC. Vibrac Steel. Motor Transport, vol. 34, no. 888. Mar. 6, 1922, p. 287, 1 fig. Described properties and tests of new steel produced by Armstrong, Whitworth & Co., which is proof against temper-brittlenes.

ALLOYS

ALUMINUM. *See Aluminum Alloys.*
COPPER. *See Copper Alloys.*

ALUMINUM ALLOYS

FAILURES. Some Cases of Failure in "Aluminum" Alloys, W. Rosenhain. Inst. of Metals Advance Paper for meeting Mar. 9, 1922, 4 pp., 2 figs.; also Engineering, vol. 113. no. 2932, Mar. 10, 1922 p. 308 2 figs. Discusses two examples of failures showing that materials which undergo serious growth, distortion, and disintegration in course of service, are not aluminum alloys in ordinary sense of that term, but materials of essentially different type.

RESEARCH. On Some Alloys of Aluminum, Walter Rosenhain and Sydney L. Archbutt Instn. Mech. Engrs. Proc., no. 7, 1921, pp. 699-725 and (discussions) pp. 727-771. Report to Alloys Research Committee representing result of organized work of practically whole staff of Metallurgical Dept. of Nat. Physical Laboratory. Deals with cast and wrought alloys permanence and constitution of alloys.

ZINC AND ALUMINUM. A Further Study of the Alloys of Aluminum and Zinc, D. Hanson and Marie L. V. Gayler. Inst. of Metals Advance Paper for meeting Mar. 9, 28 pp., 29 figs. Account of investigation. Deals with determination of the solidus; constitution of solid alloys; the constituent beta; age-hardening of constituent beta and gamma. Photomicrographs.

AMMONIA COMPRESSORS

LOSSES. Losses in Ammonia Compressors, S. F. Smith. Refrig. World, vol. 57, no. 3, Mar. 1922, pp. 25-26. The five ways in which losses occur in compression machine and conditions which control same. The two-stage compressor and its field. Paper read before Mountain States Ice Manufacturers Assn.

STARTERLESS INDUCTION MOTORS FOR. Starterless Induction Motors for Ammonia Compressors, J. Lebovici. A.S.R.E. Jl., vol. 8, no. 5, Mar. 1922, pp. 398-402 and (discussion) 402-404, 7 figs. Combines favorable characteristic of squirrel cage and slip ring types, and makes ideal drive for ammonia compressors using up to 150 hp.

ASH HANDLING

HYDRAULIC DISPOSAL SYSTEM. Handling Ashes by Sluicing, C. C Lance. Power, vol. 55, no. 13, Mar. 28, 1922, pp. 503-504, 1 fig. Calumet and Hecla Mining Co. power plant at Lake Linden, Mich., reduces ash-handling costs by hydraulic system of ash disposal.

AUTOMOBILE ENGINES

AIR COOLING. Air Cooling Progress in U. S. A., Harold F. Blanchard. Autocar, vol. 48, no. 1376, Mar. 4, 1922, pp. 355-359, 8 figs. Economy in operation important feature. Discusses air cooling as applied to Franklin, Holmes, 6-cylinder Fox, and twin-three D.A.C. cars, and explains how cooling draught is induced.

CYLINDERS. Some Aspects of Air-Cooled Cylinder Design and Development, S. D. Heron. Soc. Automotive Engrs. Jl., vol. 10, no. 4, Apr. 1922, pp. 231-260, 35 figs. Design and development of modern high-output air-cooled cylinder. Deals primarily with problems of aircraft cylinder of approximately 40 b. hp.

DEVELOPMENT. Aircraft Engine Experience as a Basis for Automobile Engine Development, H. Dechamps. Automotive Industries, vol. 46, no. 11, Mar. 16, 1922, pp. 611-613. Super-compression and over-dimensioning of engines as an aid to fuel economy.

FUEL ECONOMY. Relations Bteween Fluid Friction and Transmission Efficinecy, Neil MacCoull. Soc. Automotive Engrs. Jl., 10, no. 3, Mar. 1922, pp. 193-199, 16 figs. Experiments to determine mechanical losses, including data from E. H. Lockwood's experiments at Yale. Possibilities for increasing fuel economy of a motor vehicle. See also Lubrication, vol. 8, no. 1, Jan. 1922, pp. 1-8, 15 figs.

IGNITION AUTOMATIC. Automatic Ignition Advance. Autocar, vol. 48, no. 1376, Mar. 4, 1922, pp. 362-263, 1 fig. Describes mechanism to provide automatic spark advance by depression in inlet pipe, which is very great when throttle is almost closed, but grows less with increase of engine speed, and mechanical compensation moving with throttle mechanism.

INCREASING POWER OBTAINABLE. The Super-Power Engine G. Funck. Autocar, vol. 48, no. 1377, Mar. 11, 1922, pp. 395-400, 13 figs. Deals with mean of increasing power obtainable from engine of given cubical capacity other than those ordinary employed.

MANIFOLD DESIGN. Manifold Vaporization and Exhaust-Gas Temperatures. O. C. Berry and C. S. Kegerreis. Soc. Automotive Engrs., Jl. vol. 10, no. 3, Mar. 1922, pp. 171-176, 10 figs. Discusses low volatility of fuel for internal-combustion engine as cause of uneconomical utilization of fuel and of engine maintenance troubles. Tests carried out.

TWO-STROKE. An Investigation of Certain Aspects of the Two-Stroke Engine for Automobile Vehicles, F. W. Lanchester and R. H. Pearsall. Automobile Engr., vol. 12, no. 160, Feb. 1922, pp. 55-62, 16 figs. Investigation of principal factors controlling performance of internal-combustion engines functioning on two-stroke cycle, especially small size engines of simplest forms adapted to work at comparatively high revolution-speeds. Paper before Inst. Automobile Engrs.

AUTOMOBILE FUELS

ALCOHOL. The Use of Alchol as Fuel in Exported Vehicles, Herbert Chase. Automotive Industries, vol. 46, no. 14, Apr. 6, 1922, pp. 771-773, 1 fig. Use of alcohol in Spanish-American countries because of less cost, and adaptation of vehicles for use of alcohol. Discusses problems met in its use and suggests remedies.

AUTOMOBILES

BRAKES. Developing a Method for Testing Brake-Linings, S. von Ammon. Soc. Automotive Engrs. Jl., vol.10, no. 3, Mar. 1922, pp. 153-162, 23 figs. Describes equipment developed and methods used for tests; coefficient of friction; endurance tests with cooled drum; severe-service test with uncooled drum; etc.

Passenger-Car Brakes, J. Edward Schipper. Soc. Automotive Engrs. Jl., vol. 10, no. 4, Apr. 1922, pp. 273-289, 29 figs. Comprehensive survey of present braking practice and outline of future requirements and possibilities; design factors; future of brakes..

The Perrot-Hallot Brake (Die Perrot-Hallot-Bremse), Claus Syrlin. Allgemeine Automobit Zeitung, vol. 23, no. 1, Jan. 7, 1922, pp. 33-34, 2 figs. Details and principle of automobile brake developed by Hallot and Perrot, tests with which recently caried out under auspices of Royal English Automobile Club showed excellent results.

GEAR BOXES. Improvements in Gear-box Design, H. F. L. Orcutt. Automotive Industries, vol. 46, nos. 9, 10 and 11, Mar. 2, 9 and 16, 1922, pp. 511-514, 563-565 and 617-621, 5 figs. Mar. 2; Points out some of usual defects and outlines methods of improvement. Mar. 9: Methods employed to carry on special gear-boxe gear tests. Describes new gear-tooth grinding process. Mar. 16: Factors in production of gear boxes, and suggestions for iimprovements in design. Condensed from paper read before Instr. Automobile Engrs.

MINIATURE FOUR-CYLINDER. Miniature "Fours." Autocar. vol. 48, no. 1378, Mar. 18, 1922, pp. 431-435, 9 figs. Description of some of best known of modern four-cylinder engines having piston displacements of less than 1,000 cc.

MODERN PLANT DESIGN. Designing a Modern Automobile Plant, Paul L. Battey. Iron Age, vol 109, nos. 10 and 11, Mar 9 and 16, 1922, pp. 652-656 and 713, 14 figs· What is involved in relation of departments and in many services now demanded. View of future in industrial developments. Providing power, heating water supply and others services Details of plant and manufacturing procedure of the Willys Corp , Elizabeth, N. J. Based on paper presented before Am Soc. Mech. Engrs.

STEAM. A Steam Car That Is Different. Sci. Am., vol. 126, no. 4, Apr. 1922, p. 262, 4 figs. Details of new Coats steam car having gas-car control and finish with steam-car smoothness.

SUSPENSION. A New Suspension System. Auto, vol. 27, no. 7, Feb. 16, 1922, p. 136, 1 fig. Some details of the Gattie device in which helical springs are utilized.

AVIATION

AERIAL TRANSPORTATION. Aerial Transport Today and Tomorrow, W. A. Bristow. Aerial Age, vol. 14, no. 26, Mar. 6, 1922, pp. 616-618 and 627 and vol. 15, no. 2, Mar. 20, 1922, pp. 35 and 38. Also abstract in Flight, Feb. 16, 1922, p. 99. Discusses present situation depending on subsidies of some sort, the building up of merchant air fleets as main reliance for military air fleets, and increased passenger traffic requires.

CIVIL. The Air Conference. Flight, vol. 14, no. 6, Feb. 9, 1922, pp. 83-86, 2 figs. Summary of Lord Gorell's paper on Civil Aviation, discussing factors of successful development, service and civil sides, progress, necessity for more research work, cross-channel services, imperial air services, air mails, policy of subsidization, etc.

AXLES

MILLING ECCENTRIC KEYWAYS IN. . Device for Milling Eccentric Keyways in Axles of Locomotives After the Axles are Pressed Into the Wheels. Ry. and Locomotive Eng., vol. 35, no. 3, Mar. 1922, pp. 58-59, 3 figs. Details of construction and application.

B

BEAMS

BROAD-FLANGED. Broad-Flanged Beams (Breitflanschige Träger). H. Schaper. Eisenbau, vol. 13, no. 2, Feb. 17, 1922, pp. 30-32, 1 fig. Describes improved type manufactured by the Peiner Rolling Mills, Peine, Germany, with parallel flange surfaces, whereas in older types, the inside flange s rfaces had an inclination of 9 per cent. ,

REINFORCED-CONCRETE. Deflection of Reinforced Concrete Beams of Rectangular Cross Section, Frank. P. McKibben. Cement and Eng. News, vol. 34, no. 3, Mar. 1922, pp. 20-22. Presents general formula for vertical deflection. Verification of deflection equations by use of Castigliano's theorem. Application.

TILTING LOAD. The Tilting Load of I-Beams (Die Kipplast des I-Trägers). G. Unold. Eisenbau, vol. 13, no. 2, Feb. 17. 1922, pp. 25-30, 3 figs. Based on work of Timoecenko (Zeit. für Mathematik u. Physik. 1910, p. 360). writer develops a simplified but entirely reliable method of calculating tilting load of I-beams.

BEARINGS, ROLLER

STREET CARS. Roller Bearings in the Municipal Street-Railway Cars of Hagen (Germany) (Rollenlarger im Betriebe der Hagener Strassenbahn), K. Pforte. Verkehrstechnik, vol. 29, no. 7, Feb. 17, 1922, pp. 80-83, 4 figs. Describes Jaeger type of roller bearings adopted by municipal street railway as substitute for uneconomic journal bearing for motors and axle bearings, and points out their value in reducing cost and increasing safety. Advantages over ball bearings.

BELTING

POWER TRANSMISSION BY. Power Transmission by Belting, W. G. Dunkley. Eng. and Indus. Management, vol. 7, no. 10 Mar. 23, 1922, pp. 280-281, 2 figs. Describes common faults which are met with in works, and suggests methods by which they may be satisfactorily overcome. Notes on belt design, stresses and tension.

BENDING MACHINES

BOILER-PLATE. A New Boiler-Plate Bending Machine of Vertical Type with Electric Drive (Eine neune Kesselblechbiegemaschine stechender Anordnung mit elektrischem Antrieb), Hugo Becker. Schiffbau, vol. 23, nos. 22-23, Mar. 1-8, 1922, pp. 690-693, 6 figs. Describes new type of bending press for boiler plate which is claimed to show marked improvements and advantages over older types.

BOILER FEEDWATER

TREATMENT. Advantages of Treating Locomotive Feed Water. Boiler Maker, vol. 22, no. 3, Mar. 1922, pp. 66-68. Quality of boiler water; treatment to prevent scale and plants designed for the purpose; gives questionnaire on water treatment To be presented at 1922 meeting Master Boiler Makers' Assn.

Treated Water Improves Locomotive Performance, W. A. Powanall. Ry. Mech. Engr., vol. 96, no. 4, Apr. 1922, pp. 191-192. Systematic methods of water treatment by soda ash process.

BOILER OPERATION

EFFICIENT. The Expectation of Efficiency of Steam Boiler Operation, Hugh R. Carr. Power Plant Eng., vol. 26, no. 7, Apr. 1, 1922, pp. 357-360, 2 figs. Discusses variables entering into the question, viz.; type of draft, combustion rate, coal, ratio of heating to grate surface, point of maximum heat intensive. Proposes empirical curves for determining efficiency with fair degree of accuracy.

RATING PERCENTAGE. Percentage of Boiler Rating. Power, vol. 55, no. 14, Apr. 4, 1922, pp. 531-532. What it means and how it is figured. Presents table for simplifying computations.

BOILERS

ADAPTATION TO LOW-GRADE FUEL. Reconstruction of Coke Sectional Boilers for the Burning of Substitute Fuels (Umstellung von Koksgliederkesseln auf Ersatsbrennstoffe), H. Pradel. Braunkohle, vol. 20, no. 45, Feb. 11, 1922, pp. 705-711, 12 figs. Details of improvements in boilers by German boilermakers for use of low-grade fuel.

DESIGN AND OPERATION. Steam Boilers, F. W. Dean. N. E. Water Works Assn. Jl., vol. 36, no. 1, Mar. 1922, pp. 115-139 and (discussion) pp. 139-140, 5 figs. Notes on internally and externally fired boilers; fire-tube and water-tube boilers; workmanship; baffles; method of taking steam from boilers; height of boilers; above floor;height of bridge walls; locomotive-type boilers; feedwater regulators; temperature of escaping gases; mechanical and hand stokers; pulverized coal; oil fuel; feeding boilers; etc.

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Electrically Heated. Electrically Heated Boilers (Elektrodampfkessel), H. Schneider. Archiv. für Wärmewirtschaft, vol. 3, no. 2, Feb. 1922, pp. 27-28. vol. 3, no. 2, Feb. 1922, pp. 27-28, [illegible] figs. Comparison with steam generation with coal firing. Types of electrically heated boilers.

Heat-Loss Determination. A New Method of Determining Heat Losses by Means of the Combustible Gases in Exhaust Gases of Boilers (Ein neues Verfahren zur Bestimmung der Wärmeverluste durch brennbare Gase in den Abgasen der Kesselfeuer), O. I. Hansen. Zeit. des Bayerischen Revisions-Vereins, vol. 26, nos. 1, 2 and 3, Jan. 15, 31 and Feb. 15, 1922, pp. 3-5, 13-15 and 21-22, 4 figs. Describes method and apparatus with which it is possible to determine heat loss with sufficient accuracy. Account of tests carried out by K. E. Nielsen in Copenhagen, Denmark, gas works.

High-Pressure. The Thermo-Dynamics of Extra High Pressure Steam in Connection with Power and Heat Economics, O. H. Hartmann. Eng. Progress, vol. 3, no. 3, Mar. 1922, pp. 45-48, 7 figs. Describes vertical-tube boiler for pressure of 60 atmos. developed by Wilhelm Schmidt which can generate steam at this atmosphere and up to temperature of 480 deg. cent. Tests with extra-high pressure steam engines, and importance of these engines for heat economics. Possibilities of application of extra-high-pressure steam in connection with combined power and heating installations.

Locomotive. *See Locomotive Boilers.*

BOILERS, WATER-TUBE

Design. Standard Rules Governing The Construction of Water-Tube Boilers. Shipbldg. and Shipg. Rec., vol. 19, no. 11, Mar. 16, 1922, p. 335. Deals with Part V of Standard Conditions for Design and Construction of Marine Boilers and Shafting, prepared by British Marine Engineering Design and Construction Committee.

BOLTS

Tightening by Use of Liquid Air. Experimental Use of Liquid Air and Explosives for tightening Body-Bound Bolts, H. L. Whittemore. Am. Mach., vol. 56, no. 14, Apr. 6, 1922, pp. 524-526. Cylindrical and taper bolts contracted by liquid air and allowed to expand after insertion. Cylindrical bolts expanded in place by explosives.

BRAKES

Freight-Train. Continuous Brake for Long Freight Trains (Le freinage continu des longs trains de marchandises), J. Netter. Le Génie Civil, vol. 79, nos. 26 and 27, Dec. 24 and 31, 1921, pp. 557-561 and 585-590, 28 figs. Dec. 24: Discusses tests in profress by Commission of French Public Works. Describes situation before and after war, also the Westinghouse triple-valve brake. Dec. 31: The Kunze- Knorr and Lipkowski compressed-air brakes and the Clayton-Hardy vacuum brake. Results of tests carried out.

BRASS

Forgings, Manufacture of. The Manufacture of Brass Forgings, C. T. Roder. Iron Age, vol. 109, no. 13, Mar. 30, 1922, pp. 857-858, 2 figs. Called also die pressing or hot forging. Details of process developed in United States during war. Physical and other propertirs.

BREAKWATER

Pile. Curved Pile and Rock Breakwater Built in Deep Water. Eng. News-Rec., vol. 88, no. 13, Mar. 30, 1922, pp. 539, 2 figs. Desvribes building pile breakwater on curves of varying radii in water 15 ft. deep, at Chicago.

BRIDGES, CONCRETE

Deterioration. Concrete Bridges Show Deterioration. Contract Rec., vol. 36, no. 14, Apr. 5, 1922, pp. 301-302. Reinforcement in columns, chords and railings of two concrete truss structures in Nashville, Tenn., found to be badly rusted after 12 years' service. Stability seriously affected.

BRIDGES, HIGHWAY

Concrete Arch. Maryland Street Bridge, Winnipeg, J. F. Greene. Eng. Jl. (Eng. Inst. Can.), vol. 5, no. 4, Apr. 1922, pp. 197-201, 5 figs. Discusses design as affected by local conditions and aesthetic considerations. Describes two-arch concrete bridge, with details of concrete tests, etc. See also, Eng. News-Rec., vol. 88, no. 15, Apr. 13, 1922, pp. 608-611, 1 fig., and Can. Engr., vol. 42, no. 13, Mar. 28, 1922, pp. 339-342. 4 figs.

Steel Rib Reinforcement Used for Concrete Arch Centers. Eng. News-Rec., vol. 88, no. 13, Mar. 30, 1922, pp. 514-519, 10 figs. Monumental concrete bridge across Connecticut River at Springfield, Mass. Saves cost of falsework. How stresses are figured.

BRIDGES, LIFT

Bascule. Chicago Double-Deck Drawbridge with Elevated Railway. Eng. News-Rec., vol. 88, no. 14, Apr. 6, 1922, pp. 567-571, 9 figs. Double-leaf trunnion bascule of 268-ft. span. Operating pinions engage racks in trusses. Massive truss members and supporting girders.

BRIDGES, MOVABLE

Floating. A Design of Floating Bridge on the Suez Canal, Edward A. Smith. Instn. Min. and Metallurgy Bul., no. 209, Feb. 1922, pp. 1-3. Describes bridges erected at Kubri, Shalufa and Kantara with movable span consisting of two 100-ton steel barges strengthened internally by timbering and joined end to end by heavy timber trusses.

BRIDGES, RAILWAY

Calculations. Ministry of Transport New Regulations for the Calculation of Railway Under Bridges, H. W. Hall, Ry. Gaz., vol. 36, no. 11, Mar. 17, 1922, pp. 483-484. How new regulations effect amount of steel required in girders for bridge construction as against amount put in under former methods of calculation.

Centrifugal Forces, Influence of. Influence of Centrifugal Forces in Railway Bridges (Einfluss der Flienhkräfte bei Eisenbahnbrücken), H. Kommerell. Zentralblatt der Bauverwaltung, vol. 42, no. 15, Feb. 18, 1922, pp. 84-88, 5 figs. Formulas are developed for bridges in curves, from which bending moments and shearing forces due to centrifugal force from horizontal wind bracing as well as those to be taken up by the two main girders can be calculated.

BRIDGES, STEEL

Continuous Truss. The Continuous Truss Bridge Over the Ohio River at Sciotoville, Ohio, of the Chesapeake and Ohio Northern Railway, Gustav Lindenthal. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 3, Mar. 1922, pp. 409-452, 26 figs. Distinguishing features of design are: continuous trusses over two long spans: floor beams, acting as inverted arches and braced against tractive forces; erection with minimum of falsework and without extra material in trusses; riveted connections to limit of largest rolling mill and shop facilities.

Reinforcement. Economy in the Reinforcement of Bridges (Kostenersparnisse bei Brückenverstärkungen), Edgar Schmidt. Bauingenieur, vol. 3, no. 3, Feb. 15, 1922, pp. 65-70, 13 figs. Shows saving of material which can be effected in reinforcement of wrought iron bridges with mild steel, by taking into consideration the effect of combining the two different materials.

Strengthening. Strengthening a Bridge Roadway with Minimum Cost (Verstärkung einer Brackenfahrbahn bei geringstem Kostenaufwand), E. Schmidt. Bauingenieur, vol. 3. no. 4, Feb. 28, 1922, pp. 113-116, 8 figs. Describes economical method of reinforcing steel bridges.

BRIDGES, SUSPENSION

Delaware River. The Delaware River Bridge, Ralph Modjeski. Engrs. and Eng. vol. 1, no. 1, Jan. 1922, pp. 1-5 and (discussion) 5-16, 5 figs. Center span will be 750 ft. between towers; two cables supporting it, 30 in. in diameter, each composed of 16,500 individual wires, will cost 128,000,000. Address before Am. Soc. Civil Engrs.

BUILDING CONSTRUCTION

Costs. Relative Cost of Building Construction for Last 9 Years, Halbert P. Gillette. Eng. and Contracting, vol. 57, no. 12, Mar. 22, 1922, pp. 264-266. Gives table of cost indexes compiled by author and others.

BUILDINGS

Cooling Systems. Cooling Systems of Buildings, A. M. Feldman. A. S. R. E. Jl., vol. 8, no. 5, Mar. 1922, pp. 377-389 and (discussion) 389-392, 12 figs. Discusses cooling of rooms in office buildings, auditorium, hotels, hospitals, etc., and describes tests made at Kuhn, Loeb & Co. bank building, N.Y., also cooling arrangements at Mt. Sinai Hospital of New York City.

BUSBARS

Current Distribution in Multi-Conductor. Current Distribution in Multi-Conductor Single-Phase Buses, C. F. Wagner. Elec. World, vol. 79, no. 11, Mar. 18, 1922, pp. 526-529, 7 figs. Study of phenomena involved is necessary to design busbars for generating and distribution systems of large capacity if cost of construction is to be minimized. Simple graphical method is presented.

BUSES

Trolley. The Operation of a Self-Contained Trolley Omnibus System, J. B. Parker. Tramway and Ry. World, vol. 51, no. 13, Mar. 16, 1922, pp. 117-123, 13 figs. Describes operation of system controlled by Tees-side Railless Traction Board, and gives operating costs of new trolley buses.

C

CABLEWAYS

Aerial. Aerial Cableways (Les transporteurs aériens à cables), Cretin. Génie Civil, vol. 80, nos. 4 and 5, Jan. 28 and Feb. 4, 1922, pp. 75-79 and 103-105, 15 figs. Jan. 28: Discusses analytical calculations with examples. Feb. 4: Tension of cableways and calculation of loads.

CAMS

Design. Design of Cams (Einiges über die Nockenscheiben der Motoren), Arthur Balog. Wirtschaftsmotor, no. 12, Dec. 25, 1921, pp. 19-21, 5 figs. It is shown how, for different types of engines (for example, Diesel Engines), a uniform basis can be developed for design of uniform, easily-made cams.

CANAL LOCKS

Boat Lift. The Submersible Boat Lock" as Solution to Problem of Boat Lifts (Die "Tauchbootschleuse", ein Beitrag zur Lösung des Problems der Schiffshebewerke) E. Burkhardt. Schweizerische Bauzeitung, vol. 79, no. 9, Mar. 4, 1922, pp. 113-115, 3 figs. Describes new patented arrangement, based on utilization of buoyancy of water, consisting of cylindrical submersible body which is moved up and down in submersible shaft filled with water.

CAR WHEELS

Chilled-Iron, Manufacture. Car Wheel Manufacture Revolutionized, Gilbert L. Lacher. Iron Age, vol. 109, nos. 13 and 14, Mar. 30 and Apr. 6, 1922, pp. 847-852 and 939-943, 8 figs. Describes practice at plant of Griffin Wheel Co. at Council Bluffs, Iowa. Notes on mechanical molding; charging and handling of cupolas; sand preparation; ore making and baking.

Flange Welding. Getting Wheel Mileage Without a Lathe. Elec. Traction, vol. 18, no. 3, Mar. 1922, pp. 214-215, 6 figs. Utilization of welding and cutting torch instead of wheel-turning lathe by Terre Haute, Indianapolis and Eastern Traction Co.

Machining. Machining and Mounting Wheels and Axles, Charles Petrain. Ry. Mech. Engr., vol. 96, no. 3, Mar. 1922, pp. 148-150, 1 fig. Gaging-worn axles and rolled-steel wheels; welding cast steel wheels (Abstract). Paper read before Car Foremen's Assn. of Chicago.

CARS

Hose Connector, Automatic. Recent Changes in American Hose Connectors. Ry. Mech. Engr., vol. 96, no. 3, Mar. 1922, pp. 141-143, 4 figs. Manufactured by Am. Automatic Connector Co., Cleveland, Ohio. Passenger heads interlocked under pressure; permanently attached freight interchange adapter.

CARS, FREIGHT

INTERCHANGE. On the Question of Interchange of Rolling Stock (all countries except America), M. Charron. Int. Ry. Assn. Bul., vol. 4, no. 3, Mar. 1922, pp. 479-535. Report on interchange of goods rolling stock (freight cars), and penalty charges in case of delay in return of that stock; rules to be adopted in relations between railways themselves; rules to be adopted in relations between railways and consignors and consignees.

CAST IRON

WELDING. The Dependability of Cast Iron Welding, G. O. Carter. Iron Age, vol. 109, no. 14, Apr. 6, 1922, pp. 928-930, 8 figs. Preheating and annealing essential correct preparation of casting. Some results attained commercially. (Abstract.) Paper read before Cleveland section, Am. Welding Soc.

CASTING

CENTRIFUGAL. Producing Centrifugal Castings, H. Cole Estep. Iron Trade Rev., vol. 70, no. 13, Mar. 30, 1922, pp. 887-892, 19 figs. Process employed in England for making gray iron and nonferrous castings. Micrographs show effect of centrifugal force. See also Foundry, vol. 50, no. 6, Mar. 15, 1922, pp. 217-222, 19 figs.

CENTRAL STATIONS

MODERN CONSTRUCTION. Modern Tendencies in Central Station Construction Les tendances modernes dans la construction des centrales), F. Scoumanne. Société Belge des Electriciens, vol. 35, Sept.-Oct. and Nov.-Dec. 1921, pp. 221-224 and 252-257, and vol. 36, Jan.-Feb. 1922, pp. 19-25, Sept.-Oct.: Discusses choice in the power of units, boilers and economizers, steam piping, coal and ash handling, automatic stoking, forced draft, etc. Nov.-Dec.: Deals with machinery room, including turbines, alternators, condensers. Jan.-Feb.: Switchboard arrangements, including bus-bars and distribution of current.

MONTREAL STREET RAILWAY. The Main Plant of the Montreal Street Railway, T. H. Fenner. Power House, vol. 15, no. 6, Mar. 20, 1922, pp. 15-21, 10 figs. Describes Hochelaga power house and its equipment, including 22 water-tube boilers, turbo generators, direct connected reciprocating units of large size, etc.

SUPERPOWER. The Superpower System. Am. Inst. Elec. Engrs., vol. 42, no. 4, Apr. 1922, pp. 287-297. Two articles dealing with essential elements of superpower plant. The first, by Henry Flood, Jr., deals with steam-electric plants proposed by system; and second, by L. E. Imlay, deals with hydroelectric plants, transmission system and superpower system as a whole.

CHAIN DRIVE

INVERTED- AND ROLLER-TOOTH TYPE. Chain Drives, A. Bayliss. Eng. and Indus. Management, vol. 7, no. 10, Mar. 23, 1922, pp. 282-286, 3 figs. Practical notes concerning two main types, viz. (1) inverted tooth and (2) roller tooth type Describes rocker joint chain.

CHROME STEEL

ETCHING MEDIUM FOR TUNGSTEN AND. New Etching Medium for Chromium and Tungsten Steels. Iron Age, vol. 109, no. 11, Mar. 23, 1922, p. 790, 1 fig. Special solution for detecting presence of carbides. Valuable as applied to high-speed steels. Translated from article by K. Daeves in Stahl u. Eisen, Sept. 8, 1921.

CHUCKING MACHINES

AUTOMATIC, FOR RAILWAY SHOPS. An improved Automatic Machine For Railway Shops. Ry. Gas., vol. 36, no. 9, Mar. 3, 1922, pp. 351-352, 2 figs. Describes the Victor automatic chucking machine, made by W. G. Armstrong, Whitworth & Co. Ltd.

CITY PLANNING

ZONING. Proposed Zoning Ordinance for Philadelphia, Joseph C. Wagner and George R. Mackenzie. Engrs. and Eng., vol. 1, no. 2, Feb. 1922, pp. 33-47 and 64, 13 figs. Explains proposed ordinance drafted by Zoning Commission, for establishment of regulations for location, size and use of buildings in city to promote public health, safety, order and general welfare.

COAL

SELECTION. Selection of Most Suitable Coal for a Given Plant Is Engineering Problem Involving Diverse Factors, O. P. Hood, Coal Age, vol. 21, no. 11, Mar. 16, 1922, pp. 443-444. How some purchasing agents buy coal; importance of uniformity in pooling coal; equipment must be adapted to fuel chosen. Based on address before Nat. Assn. Purchasing Agents.

BITUMINOUS, UTILIZATION. The full Utilization of Bituminous Coal. Iron and Coal Trades Rev., vol. 103, no. 2805, Dec. 2, 1921, p. 805, vol. 104, nos. 2810 and 2814, Jan. 6 and Feb. 3, 1922, pp. 4-5 and 162-163. Dec. 2: What constitutes the coking quality of a coal. Factors in coke formation. Jan. 6: Manipulation of coke-forming factors; examination, selection and mixing of coals; process factors; coke handling. Feb. 3: Low-temperature carbonization of coal. See also Gas Jl., vol. 156, no. 3056, Dec. 7, 1921, p. 686, and vol. 157, nos. 3060 and 3065, Jan. 4 and Feb. 8, 1922, pp. 28-30 and 319-321.

BRIQUETTING. Ontario Establishes Another Plant for Briquetting Anthracite Fines with Crude-Oil Residuum, J. B. McGraw. Coal Age, vol. 21, no. 10, Mar. 9, 1922, pp. 403-406, 3 figs. Methods of drying coal, receiving binder and intimately mixing it with coal; new system of cooling briquettes.

A Great Fuel Works. Colliery Guardian, vol. 123, nos. 3190 and 3191, Feb. 17 and Mar. 3, 1922, pp. 405-408 and 531-533, 17 figs. Describes plant and equipment of Rose Patent Fuel Co., Ltd., to convert fines of best Welsh coals into highest class of patent fuel briquettes

COAL-CUTTING BY MACHINERY. The Limitations of Coal Cutting by Machinery. Instn. Min. Engrs. Trans., vol. 62, Part 4, Feb. 1922, pp. 254-272. Discussion covering average cost of coal cutting and machine mining, advantages and disadvantages of coal cutters.

COAL DUST

EXPLOSION. The French Coal Dust Experiments, E. Audibert. Colliery Guardian, vol. 123, no. 3195, and 3196 Mar. 24 and 31 1922, pp. 725-726 and p. 788, 3 figs. Discusses results of experiments by Taffanel at Lievin testing station, including mechanics of dust explosions, propagation in dusty atmosphere, aptitude of dust deposits to propagation, preventive measures, and arresting spread of explosion. From Annales des Mines.

COAL GAS

MANUFACTURE. Coal Gas Manufacture, Jerome J. Morgan. Coal Industry, vol. 5, no. 2, Feb. 1922, pp. 87-91, 3 figs. Processes of manufacture in horizontal inclined and vertical retorts. Trent of gas industry.

COAL HANDLING

AUTOMATIC. Automatic Coal and Ash Handling Plant, E. W. L. Nicol. Chem. Age. (Lond.), vol. 6, no. 141, Feb. 25, 1922, pp. 234-236, 7 figs. Describes rotary truck tippler, the U. link conveyor, and the "sandwich" system of feeding coke and coal.

COAL INDUSTRY

WASTE ELIMINATION. Elimination of Waste in the Coal Industry, Edwin Ludlow. Min. and Metallurgy, no. 183, 'Mar. 1922, pp. 39-40. Deals with waste in bituminous field.

COAL MINES

ELECTRICAL DEVELOPMENTS. Electrical Developments in Coal Mines, M. S. Beddow. Coal Industry, vol. 5, nos. 2 and 3, Feb. and Mar. 1922, pp. 108-112 and 152-153, 4 figs. Feb: Relative merits of various kinds of haulage; advantages of electric haulage; popularity of storage battery loconotive; improvements made in trolley type; care of ball bearings. Mar.: Electric developments from small d.c. steam-driven generator to small central power plant; superpower system of future.

FANS. Modern Mine Fans, David Penman. Min. Mag., vol. 26, nos. 2 and 3, Feb. and Mar. 1922, pp. 73-81 and 146-153, 19 figs. Feb.: Volume of air necessary for adequate ventilation; principle of centrifugal fan; effect of shape of blades; evasee chimney; the Waddle, Walker indestructible, Capell, Sirocco, Keith, brightside, Jeffrey and Turbon fans. Mar.: Methods of driving fan; surface versus underground fans; exhaust versus blowing fans; fans in combination; factors governing increased ventilation.

COKE

BLAST-FURNACE. Blast-Furnace Coke, D. Bagley. Iron & Coal Trades Rev., 104, no. 2815, Feb. 10, 1922, pp. 204-206, 15 figs. Report by Heinrich Koppers to Blast Furnace Committee of German Iron Assn., distinguishing between blast-furnace fuels characterized by relative velocity of combustion and suggesting certain modifications in coking process with object of producing more readily combustible fuel with some diminution in consumption per unit of iron. From Stahl u. Eisen.

COKE MANUFACTURE

PACIFIC NORTHWEST. Review of Coking in the Pacific Northwest, Joseph Daniels. Coal Industry, vol. 5, no. 2, Feb. 1922, pp. 113-114. Coal from Washington mines is badly crushed and much fines made in mining, necessitating coal washing.

COLUMNS

STEEL, FORMULAS FOR. Comparison of Formulas for Steel Columns, N. B. Hunt. Machy. (Lond.), vol. 19, no. 492, Mar. 2, 1922, pp. 661-663, 4 figs. Graphs of a number of the most familiar formulas for an allowable unit stress of 12,000 lb., in accordance with recommendation of special committee on steel columns and struts of Am. Soc. Civ. Engrs.

COMBUSTION

AIR REQUIRED FOR. Air Required for Combustion of Gases in Steel Plants, R. T. Haslam and A. F. Spiehler. Blast Furnace and Steel Plant, vol. 19, no. 3, Mar. 1922, pp. 174-175, 1 fig. Determination of amount of air required for combustion of various gases from B.t.u. content of gas.

CONCRETE

MOISTURE CONTENT. Effect of Moisture Content on Concrete. Eng. and Contracting, vol. 57, no. 12, Mar. 22, 1922, pp. 278-280, 4 figs. Results of studies made in experiment station of University of Illinois to determine effect of moisture content upon expansion and contraction of plain and reinforced concrete. (Abstract). University of Ill. Bul.

CONCRETE, REINFORCED

FIRE RESISTANCE. The Behavior of Concrete and Reinforced Concrete When Exposed to Fire (Beton und Eisenbeton im Feuer), M. Gary. Beton u. Eisen, vol. 21, no. 3, Feb. 10, 1922, pp. 46-48. Review of tests carried out by buildngi material testing bureau in Berlin-Dahlem on concrete and reinforced concrete houses. Recent fires in large buildings in Germany demonstrate excellent fire-resisting properties of reinforced concrete.

CONCRETING

QUEENSTON-CHIPPAWA CANAL. Placing 410,000 Cu. Yd. of Concrete on Ontario's Niagara Power Development, A. C. D. Blanchard and R. B. Young. Eng. News-Rec., vol. 88, nos. 14 and 15, Apr. 6 and 13, 1922, pp. 554-559 and 613-615, 12 figs. Apr. 6; Plant layout for mixing and placing concrete for power house, forebay and lining of 9-mi. Queenston-Chippawa canal. Design and testing of mixtures to meet prescribed strengths. Apr. 13: Source of aggregate, storage of cement and aggregate and testing of cement and concrete.

CONVERTERS

ROTARY. Rotary Converters, with Special Reference to Railway Electrification, F. P. Whitaker. Electrician, vol. 88, no. 2285, Mar. 3, 1922, pp. 258-260, 3 figs. Discusses characteristics that converting apparatus for railway substations should possess. Shows how far modern rotary converter specially developed for more exacting requirements of 1500 V d.c. can fulfil conditions of service even when operating from 50 period systems. (Abstract.) Paper read before Instn. Elec. Engrs.

STREET-RAILWAY-CURRENT. Tram-Current-Converters. Eng. Process, vol. 3. no. 3, Mar. 1922, pp. 61-63, 7 figs. Discusses three types of machines used for conversion of three-phase current, namely, motor generators, cascade converters and single-armature rotary converters.

CONVEYORS

CHEMICAL INDUSTRY. Conveying Machinery in the Chemical Industry, George Frederick Zimmer. Chem. Age (Lond.), vol. 6, no. 141, Feb. 25, 1922, pp. 230-233, 12 figs. Fundamental principles which should underlie economical employment of labor-saving devices; review of most suitable mechanical handling devices for specific purposes of chemical industry.

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PORTABLE. Handling with Portable Conveyors, F. J. Tournier. Gas Age-Rec., vol. 49, no. 11, Mar. 18, 1922, pp. 317-323, 18 figs. Discusses development of machinery for moving material, up to most recent designs of apparatus for the purpose.

TYPES. Conveying and Elevating Machinery, Gardner Mitchell, Instn. Mech. Engrs. Proc., vol. 2, no. 8, Dec. 1921, pp. 895-916 and (discussion) pp. 931-969, 16 figs. Deals with different types of conveyors and elevators.

COPPER ALLOYS

CUPRO-NICKEL, COLD WORK IN. The Internal Mechanism of Cold Work and Recrystallisation in Cupro-Nickel, Frank Adcock. Inst. of Metals. Advance Paper for meeting Mar. 8, 1922, 20 pp. 45 figs. Results of experiments on commercial cupro-nickel (copper 80 per cent, nickel 20 per cent.) See also Engineering, vol. 113, nos. 2932 and 2933, Mar. 10 and 17, 1922, pp. 305-308 and 340-342, 45 figs.

COST ACCOUNTING

PAPER-MILL POWER PLANT. Power Costs in Paper Mill Accounting, B. C. Gause. Paper vol. 29, no. 26, Mar. 1, 1922, pp. 7-8. Classification of power expenses; apportionment of costs; overhead charges; elements of cost.

SEWAGE WORKS. Keeping Records and Accounts for a Small Sewage Works, Percy Lamb. Eng. & Contracting, vol. 57, no. 13, Mar. 29, 1922, pp. 294-295, 1 fig. Importance of accounting methods; meteorological records; method of recording results; working costs, fuel, repair, etc. (Abstract.) From 1921 Proc. of Assn. of Mgrs. of Sewage Disposal Works.

CRANES

ELECTRIC CONTROLLERS. Electric Crane Controllers, J. F. Schnable. Am. Inst. Elec. Engrs. Jl., vol. 41, no. 4, Apr. 1922, pp. 313-319, 5 figs. Deals with problems concerning selection of ohmic values for resistors, and connection arrangements and resistance values involved in dynamic braking control of lowering loads.

CUPOLAS

CENTER-BLAST TUYERE. The Bottom or Center-Blast Cupola Tuyere, Geo. O. Vair. Can. Foundryman, vol. 13, no. 3, Mar. 1922, p. 25, 1 fig. Advantages and disadvantages compared with side-blast.

FLAMELESS. Flameless Cupolas with Overgrate Blast (Flammenloser Kupolofen mit Oberwind). Zeit. für die gesamte Giessereipraxis, vol. 43, no. 5, Feb. 4, 1922, pp. 62-64. Suggestions for design and proper care of cupolas.

D

DAMS

HYDRAULIC-FILL. Core Studies in the Hydraulic-Fill Dams of the Miami Conservancy District, Charles H. Paul. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 3, Mar. 1922, pp. 453-473, 11 figs. It is shown that gradation of core material may be controlled during construction, even with borrow-pit materials of widely different character; considerable excess of fines is required in borrow-pit material; reasonably wide core may be obtained with absolute safety; fairly high percentage of extremely fine material in core is not objectionable, provided material is properly graded.

DIESEL ENGINES

1900-HP. HIGH-SPEED. Investigation of a 1900-Hp. High-Speed Diesel Engine in a Cotton Spinning Plant in Augsburg (Germany) (Untersuchung einer 1900 PSe-Schnelläufer-Dieselmaschine in der Baumwollspinnerei am Stadtbach in Augsburg), H. Deinlein. Zeit. des Bayerischen Revisions-Vereins, vol. 26, no. 4, Feb. 28, 1922, pp. 25-27, 2 figs. Results of investigation carried out by Bavarian Revisions-Verein confirmed guaranteed efficiency of engine.

NOBEL 1600-HP. Tests on a 1600-Hp. Nobel Diesel Engine (Untersuchung eines 1600 PSe-Nobel-Dieselmotors). A. Rosburg. Zeit. des Vereines deutscher Ingenieure, vol. 66, no. 6, Feb. 11, 1922, pp. 137-139, 15 figs. Investigation of two-cycle Diesel engine described in same journal (no. 3, 1922) with regard to efficiency, fuel consumption, relation of indicated work to useful work, compressor, scavenging-pump and friction work at different speeds and load conditions. Tests results.

DRIFTS

IRON FOR SUPPORTING. Use of Iron for Supporting Drifts (L'utilisation du fer au soutènement des galeries), A. Clement. Revue de l'Industrie Minérale, no. 27, Feb. 1, 1922, pp. 51-67, 17 figs. Discusses use of mild steel frames which can be adjusted cold in situ, as much more economical than wood.

DRILLING MACHINES

MULTIPLE-SPINDLE DRILL HEADS. Multiple-spindle Drill Heads, George Hey. Machy. (Lond.) vol. 19, nos. 491 and 493, Feb. 23 and Mar. 9, 1922, pp. 621-627 and 702-705, 21 figs. Feb. 23: Discusses shortcomings of multiple-spindle drill heads, and describes design of multiple-spindle adjustible type for drilling of high tensile steels. Mar. 9: Fixed center type of drill head.

DROP FORGING

PERFECTING. Perfecting a Drop Forging, J. H. G. Williams. Forging and Heat Treating, vol. 8, no. 3, Mar. 1922, pp. 152-155, 14 figs. Discusses various defects in drop forging and how to remedy them.

DRYDOCKS

FLOATING. The Machinery of Floating Docks, E. H. Salmon. Instsn. Mech. Engrs. Proc., no. 7, 1921, pp. 777-817 and (discussion) pp. 817-841, 42 figs. Deals with pumping machinery, control gear, auxiliary machinery, and berthing gear.

E

ELECTRICAL MACHINERY

LOSSES, DETERMINATION OF. The Retardation Method of Determining Losses in Electrical Machines, H. Cotton. Beama, vol. 10, no. 2, Feb. 1922, pp. 128-137, 10 figs. Discuses the Routin method; determination of retardation curve and moment of inertia.

ELECTRIC CIRCUITS

MAGNETIC BLOW-OUTS ON. Air Break Magnetic Blow-Outs, J. F. Tritle. Am. Inst. Elec. Engrs. Jl. vol. 41, no. 4, Apr. 1922, pp. 257-265, 28 figs. Tests and data on a.c. and d.c. current-rupturing apparatus and describes fundamental principles for magnetic blow-outs. Tests and experience indicate that limit of alternating voltage or current which may be successfully ruptured repeatedly in air has not yet been approached.

ELECTRIC FURNACES

BASIC-HEARTH. Basic Hearth Electric Furnace for Cast Iron, George K. Elliott. Can. Foundryman, vol. 12, nos. 10 and 11, Oct. and Nov. 1921, pp. 41-42 and 44 and pp. 32-34. Advantages of electricity over other fuel, from the standpoint of clean, sound metal and uniform chemical analysis. Paper read before Inst. British Foundrymen.

SMELTING. Smelting Iron Ore Electrically, R. Durrer. Iron Trade Rev., vol. 70, no. 12, Mar. 23, 1922, pp. 827-828, 1 fig. Comparison of operating conditions in standard and electric blast furnaces. Causes of hot and cold working. Relation of direct and indirect reduction in electric furnaces. Translated from Stahlu. Eisen, June 2, 1921.

TOOL-STEEL MELTING. Electric Tool Steel Melting Practice, W. J. and S. Stuart Green. Three important factors: Acid or basic bottoms: liquid or cold charges and double or single voltage. Electric furnace in other roles.

ELECTRIC LOCOMOTIVES

MONAPHASE. Monophase. Locomotive for Swiss Federal Railway. Ry. Elec. Engr. vol. 13, no. 2, Feb. 1922, pp. 45-50, 8 figs. Detailed description of locomotive designed for both freight and passenger service. (Abstract.) From Bulletin of Brown, Boveri & Co.

REGENERATION CHARACTERISTIC CURVES. Regeneration Characteristic Curves of Direct-Current Locomotives, C. A. Atwell. Elec. Jl., vol. 19, no. 3. Mar. 1922. pp. 113-116, 7 figs. Explains plotting of curves and regeneration characteristics.

ELECTRIC MOTORS

FRACTIONAL HORSEPOWER. The Design of Fractional H. P. Motors, W. J. John. Beama, vol. 10, 2 and 3, Feb. and Mar. 1922, pp. 120-127 and 232-241 4 figs. Feb: Constructional features and principals of design as applied to armature core. Mar. Design of commutator, magnetic circuit, and ¼ b. hp. shunt motor.

STARTERS. Electric Motor Starters, J. Anderson. Electrician vol. 88, no. 2288, Mar. 24, 1922, pp. 242-343, 4 figs. Discusses development of electric motor starter from first principles defining what is meant by starting, accelerating, and using torques. (Abstract). Paper read before Instn. Elec. Engrs.

SYNCHRONOUS. Induction-Type Synchronous Motors, Laurence H. A. Carr. Instn. Elec. Engrs. Jl., vol. 60, no. 306, Fev. 1922, pp. 165-173 and (discussion) 174-195, 21 figs. Compares characteristics and construction with other polyphase motors discusses self-synchronizing features of this type; deduces mathematical expression for limiting conditions beyond which synchronizing is uncertain.

ELECTRIC PLANTS

CONNECTING SMALL. Connecting Up Small Electric Power Stations for Better Utilization of Heads of Water (L'interconnexion des petites usines électriques en vue de la meilleure utilisation des chutes d'eau), Alfred Soulier. Revue Générale de l'Electricité, vol. 11, no. 6, Feb. 11, 1922, pp. 202-203, 1 fig. Discusses parallel running of generators using d.c. on transmission line and a.c. at each center of distribution.

ELECTRIC RAILWAY

BRAKING, REGENERATIVE. Regenerative Braking and Single-Phase Commutator Motors, B. Nordefeldt. Electrician, vol. 88, nos. 2287 and 2288, Mar. 17 and 24, 1922, pp. 312-314 and 340-341, 10 figs. Discusses regenerative braking on electric railways, especially problems arising in single-phase traction, and distinguishes between regenerative braking as a speed check on long down grades, and as required for bringing train to a standstill. Describes methods of single-phase that have been used or suggested and advantages and disadvantages of each. Abstract from Teknisk Tidskrift.

DEVELOPMENT AND EQUIPMENT. Electric Traction for Steam Railroads. Ry. Elec. Engr., vol. 13, no. 2, Feb. 1922, pp. 57-61, 1 fig. Tendencies of practice in United States. Limitations and advantages of equipment used.

TRACKLESS TRANSPORTATION VS. Trackless Transportation and the Electric Railway. Elec. Ry. Jl., vol. 59, no. 9, Mar. 4, 1922, pp. 355-362. Abstracts of papers read at Midyear Meeting of Am. Elec. Ry. Assn. How the Maryland Commission Acts, E. B. Whitman; City Service and British Conditions, C. D. Emmons; Auto Bus and Truck Goods as Interurban Feeders, Harry Reid; and California Situation Regarding Rail and Trackless Transportation, Paul Shoup.

ELECTRIC SWITCHES

DISCONNECTING. The Effect of High Currents on Disconnecting Switches, H. C. Louis and C. T. Sinclair. Am. Inst. Elec. Engrs. Jl., vol., 41, no. 4, Apr. 1922, pp. 267-277, 34 figs. With special reference to mechanical stresses resulting.

ELECTRIC TRANSMISSION LINES

HIGH-VOLTAGE. Safety Features on High Voltage Transmission Lines, C. O. Von Dannenberg. Power Plant Eng., vol. 26, no. 7, Apr. 1, 1922, pp. 373-375, 1 fig. Discusses methods and practices which make for greater protection and safety in high tension work. (Abstract.) Paper read before Am. Soc. Safety Engrs.

INDUCTIVE INTERFERENCE. Inductive Interference is Basically a Technical Problem. Elec. World, vol. 79, no. 12, Mar. 18, 1922, pp. 571-572. Points out that control within power and signal circuits must be developed; cost of control measures an important factor.

INSULATION OF HIGH-VOLTAGE. The Insulation of High Voltage Transmission Lines—Conception of a Million Volt Line, F. W. Peek, Jr. Gen. Elec. Rev., vol. 25, no. 2, Feb. 1922, pp. 111-119, 24 figs. Reviews the various factors affecting insulation of transmission lines.

PIT RIVER, CALIFORNIA. 202 Miles of Transmission Lines to Operate at 220,000 Volts, W. A. Scott. Eng. World, vol. 20. no. 3, Mar. 1922, pp. 151-153, 3 figs. Equipment outline of Pit River development in California.

PROTECTION. Protecting A.C. Transmission Line by the Ferranti Automatic Selective (Protection des réseaux à courants alternatifs par les systèmes sélectifs automatiques Ferranti), Paul Testard. Revue Générale de l'Electricité, vol. 11, no. 9, Mar. 4, 1922, pp. 235-241, 8 figs. Describes Ferranti-Field and Ferranti waters systems of protection by means of special transformers, and their operation.

SAG. Determination of the Sag of High-Tension Wires on Insulator Chains (Bestimmung les Durchhanges von Hochspannungsleitungen an Aspannisolatorenketten). Friedrich Schulze. Elektrotechnische Zeit., vol. 43, no. 7, Feb. 16, 1922, pp. 215-216, 1 fig. Describes simple and calculating method with aid of slide rule, but without use of tables or logarithms.

SWITZERLAND. Construction and Operation of High-Tension Lines in Switzerland (Bau unf Betrieb von Hochspannungsleitungen in der Schewiz), p. Beck. Elektrotechnik u, Maschinenbau, vol. 40, no. 7, Feb. 12, 1922, pp. 75-77. Discussion before the Swiss Electrotechnical Assn., dealing with the insulator problem, radiation phenomena (corona), overvoltage protection, inspection of high-tension lines and characteristic properties of electric-plant equipment. (Abstract.)

SYNCHRONIZING EFFECT OF PARALLEL. Synchronous Operation of Alternators Through Capacitance, T. Nishi. Gen. Elec. Rev., vol. 25. no. 3, Mar. 192, 1922, pp. 146-150, 13 figs. Synchronizing effect of two parallel transmission lines.

SYNCHRONOUS-MOTOR-EFFECT ON HIGH-TESBION. A Method for Determining the Synchronous Motor Effect on Tension Control of High Tension Lines (En Metode til Bestemmelse af den synkeone Motoreffekt til Spaendingsregulerin af Höjspaendingslinier), W. Rung. Teknisk Tidskrift (Elektroteknikeren, vol, 18, no, 3, Feb, 8, 1922, pp. 23-27, 2 figs. Makes a calculations and gives examples.

ELECTROLYSIS

WATER MAINS. Electrolysis Damages Main at Remote Point, G. Gale Dixon. Fire and Water Eng., vol. 71, no. 14, Apr. 5, 1922, pp. 565-566 and 584-585, 2 figs. Additional data on Akron strel force main, treated from standpoint of water-works engineer. Effects of corrosion on coated and unprotected pipes. (Abstract.) Paper read before N. E. Water Works Assn.

ELECTROMAGNETS

COILS. CALCULATION OF. Calculation of Coils for Electromagnets (Calcul du bobinage des constructions électromagnétiques) M. Mathieu. Arts et Metiers, vol. 74, no. 15, Dec. 1921, pp. 362-364, 3 figs. Divides electromagnets into those with and those without air gap. and gives examples of calculations.

EMPLOYEES, TRAINING OF

EXTENSION WORK IN FACTORY. Taking University Training to the Factory, Paul M. Atkins. Indus. Management, vol. 63, no. 4, Apr. 1922, pp. 239-242. Describes plan consisting of university extension work in individual plant.

MANUFACTURE. The Training of Workers in Manufacture, J. V. L. Motris. Am. Mach., vol. 56, no. 11, Mar. 16, 1922, pp. 400-402. Co-operative employment of engineering students. Length of shop period. Courses on technical subjects. Advanced shop and school instructions.

ENGINEERING

HUMAN ACTIVITY. Engineering as a Human Activity, H. E. Riggs. Eng. News-Rec., vol. 86, no. 11, Mar. 16, 1922, p. 435. Deals with some of non-techincal sides of engineering. Jobs and how to get them; fees and how to maintain them; etc. (Abstract). Paper before Mich. Eng. Soc.

ENGINEERS

CODE OF ETHICS. A Code of Ethics for Engineers. Min. & Metallurgy, no. 183, Mar. 1922, p. 46. Presents code and method of interpreting and administering it recommended by Joint Committee on Code of Ethics.

LICENSING. Advantages and disadvantages of Licensing Engineers, B. B. Gottsberger. Min. & Metallurgy, no. 183, Mar. 1922, pp. 47-50. Arguments for and against licensing.

PRACTISING. How Practising Engineers May Sell. Their Services. Eng. News-Rec., vol. 88, no. 13, Mar. 30, 1922, pp. 523-524. Methods of securing clientele and increasing business. Abstract of two papers at Conference of Practising Engrs. under auspices of Am. Assn. Engrs.

F

FACTORIES

SIZE AND EFFICIENCY. Considerations on Factory Size and Efficiency, Henry Baker. Engineer, vol. 133, no. 3455, Mar. 17, 1922, pp. 292-294, 2 figs. Writer concludes that factory just large enough to be well under control of one man probably represents most efficient size at present time. Future of large factory depends on overcoming difficulties of management.

FACTORY MANAGEMENT

See Industrial Management.

FOREMEN

TEACHING ABILITY, DEVELOPING. Building Up Teaching Ability in Foremen, D. J. MacDonald. Am. Mach., vol. 56, nos. 10 and 11, Mar. 9 and 16, 1922, pp. 360-361 and 406-408. Explains why average foreman is not a good teacher, and points out importance of planning teaching work, and what constitutes good teaching

TRAINING. As Foreman Is, So Is the Plant, C. R. Hook, E. A. Holbrook and Arthur Notman. Iron Trade Rev., vol. 70, no. 12, Mar. 23, 1922, pp. 820-822. Deals with training of foremen. Report of subcommittee on education of Am. Inst. Min. and Met. Engrs.

TRAINING. Foremanship Training, E. T. Teece. Indus. Management, vol. 63, no. 4, Apr 1922, pp 216-217. Notes on questions to be answered. Suggested outline of preliminary course.

FOUNDATIONS

BEARING VALUE OF SOILS. Progress Report of the Special Committee to Codify present Practice on the Bearing Value od Soils for Foundations, etc. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 3, Mar. 1922, pp. 523-580, 17 figs. Contain report on settlement; review of present methods; colloidal state of clay; progress report of tests on undisturbed clays; report of work of Bur. of Pub. Roads in investigation of soils.

FOUNDRIES

CUPOLAS. *See Cupolas.*

FREIGHT HANDLING

PACKAGE. Organization and Modern Handling of Package Freight through Freight Houses. G. Marks. N. E. R. R. Club, Feb. 14, 1922, pp. 278-289 and (discussion) pp. 289-314. Author outlines facts and methods, based on results of personal observation and operation, in handling large volumes of freight in all sorts of places under varying conditions.

FUELS

See Oil Fuels: Pulverized coal.

FURNACES, FORGING

TYPES. Discussion of Forge Furnaces, Charles Longenecker. Blast Furnace and Steel Plant, vol. 10, no. 3, Mar. 1922, pp. 194-196. Discusses soaking pits, regenerative and non-regenerative types, and furnaces of small hearth area, pointing out possibilities for saving and increased efficiency with various classes of fuel.

G

GALVANOMETERS

BALLISTIC. On the Sensitivity of Ballistic Galvanometers, Ernest Wilson. Physical Soc. of Lond., vol. 34, no. 192, Feb. 15, 1922, pp. pp. 55-64 and (discussion) 64-65, 4 figs. Discusses method whereby effects due to excessive damping in moving coil galvanometers are largely diminished. Results of experiments.

VIBRATING. On the Determination of the Damping Decrement of a Tuning Fork. Physical Soc. of Lond., vol. 34, no. 1922, Feb. 15, 1922, pp. 66-70. Discusses motion of vibrating galvanometer, evaluates e.m.f. induces in circuit by fork, and indicates its harmonic components and their decrements.

GAS DISTRIBUTION

HIGH-PRESSURE TRANSMISSION. High Pressure Gas Transmission, Floyd W. Parson. Gas Age-Rec., vol. 49, no. 10, Mar. 11, 1922, pp. 287-290, 6 figs. Possibilities for improvement in present methods of gas transmission and distribution; advantages resulting from pipe welding.

STANDARD INSTALLATIONS. Gas Distribution, A. W. H. Griepe. Am. Gas, Jl., vol. 116, no. 7, Feb. 18, 1922, pp. 155-158, 13 figs. Suggestions for standard installations.

GAS ENGINES

WORKING FLUIDS, PROPERTIES OF. Some Properties of the Working Fluid of Gas Engines, W. T. David. Engineering, vol. 113, no. 2932, Mar. 10, 1922, pp. 281-284, 2 figs. Notes on pressures developed on explosion; after-burning in gas engines; internal energy of working fluid; factors governing heat loss during explosion-expansion stroke. Results of experiments made by author.

GAS MANUFACTURE

ELECTRICAL PROCESS. The Electric Gasification of Fuels (Die Aussichten der elektrischen Vergasung von Brennstoffen), Alois Helfenstein. Zeit für angewandte Chemie, vol. 35, no. 13, Feb. 14, 1922, pp. 73-76. Describes new process of making gas from coal by aid of electricity. Advantages of electrical process.

GEAR CUTTING

MACHINE. Commercial Gear-cutting Practice Franklin D. Jones, Machy. (N. Y.) vol. 28, no. 6, Feb. 1922, pp. 437-446, 20 figs. Cutting of spur gears on automatic machines of formed-cutter type. See also Machy. (Lond.), vol. 19, no. 495, Mar. 23, 1922, pp. 749-757, 20 figs.

SHAPERS. Cutting Spur Gears on Gear Shapers. Machy. (N. Y.), vol. 28, no. 8, Apr. 1922, pp. 645-650, 14 figs. Use of machine operating with planing or shaping action and forming gear teeth by generating and formed-cutter process.

GEARS

AUTOMOBILE, WEAR IN. Wear on Various Automobile Gear Steels, E. R. Ross. Am. Mach., vol. 56, no. 14, Apr. 6, 1922, pp. 515-519, 6 figs. Results of tests showing various factors which affect wear in driving gears. A tooth-profile indicator.

AUTO-PITCH. A New Form of Gear, W. Rees Darling. Machy. (Lond.), vol. 19, no. 492, Mar. 2, 1922, pp. 664-667, 17 figs. Describes auto-pitch gear obtained by roller flow, resulting from studies of requirements of a perfect gear. (Abstract.) Read before Instn. Engrs. and Shipbuilders in Scotland.

SPIRAL BEVEL. The Spiral Bevel Gear. Machy. (Lond.), vol. 19, no. 492, Mar. 2, 1922, pp. 653-654, 2 figs. Comparison between arcs of action of spiral and helical teeth and straight teeth.

TOOTH-ROLLING MACHINE. Rolling the Teeth in Hot Gear Blanks, Frederick E. Walker, Jr. Am. Mach., vol. 56, no. 11, Mar. 16, 1922, pp. 409-412, 6 figs. Process eliminates cutting gear teeth. Rolling bevel gears in 15 seconds, and saving 20 to 40 per cent of metal.

PRODUCTION BY ROLLING PROCESS. Production of Gears by the Rolling Process. Can. Machy., vol. 27, no. 9, Mar. 2, 1922, pp. 46-47, 7 figs. Pressure required; forming of teeth; redressing die rolls; etc.

GEOLOGY

COMPUTATION OF STRATA. Graphical and Mechanical Computation of Thickness of Strata and Distance to a Stratum, J. B. Mertie, Jr. U.S. Geol. Survey Professional Paper, no. 129-C, Mar. 14, 1922, pp. 39-52, 12 figs. Graphic and numerical solution of problems. Construction of two five-variable alignment charts; of chart for solution of right triangle, to be used in conjunction with two charts above mentioned; and trigonometric computer for solution of all trigonometric formulas used in geologic field work.

ORE-HUNTING. Experiment in Ore-Hunting Geology, Augustus Locke. Min. and Metallurgy, no. 184, Apr. 1922, pp. 27-29, 1 fig. Deals with three matters related to ore-hunting: paucity of special writings applying to it; failure of scientists to concern themselves importantly with it; and resting on these conditions, certain possible activities for economic geologists.

GIRDERS

DOUBLE-LATTICE. Calculation of Double Lattice Girders (Calcul des poutres à treillis double), Léon Légens. Génie Civil, vol. 80, no. 6, Feb. 11, 1922, pp. 125-129, 14 figs. Calculation for girders with parallel chords and vertical rods to all connecting points.

GOLD MINES

Canada. Canada as a Gold Producer, Alexander Gray. Eng. and Min. Jl. Press, vol. 113, no. 4, Apr. 8, 1922, pp. 578-579. Increased capacity planned at Porcupine. Elbow Lake and other districts said to be promising.

Cariboo, B.C. Operations in the Cariboo, British Columbia, Donald D. Fraser. Eng. and Min. Jl., vol. 113, no. 12, Mar. 25, 1922, pp. 490-491. Reviews activities generally.

GOVERNORS

Steam Haulage Engines. The Governing of Steam Haulage Engines (Die Fahrtregler der Dampffördermaschinen), H. Hoffmann. Zeit. des Vereines deutscher Ingenieure, vol. 66, nos. 8, 9 and 10, Feb. 25, Mar. 4 and 11, 1922, pp. 173-177, 207-210 and 226-229, 29 figs. Uses and development of governors, and regulation of speed obtainable therewith. Astatic and static regulation. Nature and strength of static centrifugal governors; changing from one direction to the other; regulation of start, Examples of modern governors.

GRAIN ELEVATORS

Automatic Box-Car Unloader. Automatic Box Car Unloading in Grain Elevators, C. D. Howe. Can. Ry. & Mar. World, no. 290, Apr. 1922, pp. 169-172, 6 figs. partly on p. 173. Describes automatic box-car unloader developed for use in reconstruction of Can. Nat. Rys. elevators at Port Arthur, Ont. which has storage capacity of over 8,500,000 bush. of grain.

Pneumatic. Discharge of Grain Cargoes in the Port of London by Pneumatic Elevators, R. E. Knight. Instn. Mech. Engrs. Proc., vol. 2, no. 8, Dec. 1921, pp. 917-931 and (discussion) pp. 931-969, 10 figs. Deals with pneumatic discharge of grain from ships.

GRINDING MACHINES

Centerless. Centerless Grinding Efficiency, H. J. Swanson. Abrasive Industry, vol. 3, no. 3, Mar. 1922, pp. 75-76, 1 fig. Rapid production is possible as wheel cuts continuously; results of practical tests are given and inspection methods are described.

Chilled Iron Rolls. Large Grinding Machine for Chilled Iron Rolls. Engineer, vol. 133, no. 3455, Mar. 17, 1922, pp. 306, 2 figs. on p. 307. Describes heavy roll machine with capacity for work up to 36 in. diam. by 18 ft. between centers.

Tool and Cutter. An Imoroved Tool and Cutter Grinder. Eng. Production, vol. 4, no. 75, Mar. 9, 1922, pp. 225-226, 5 figs. Details of Improved pattern of universal machine by Alfred Herbert, Ltd., Coventry, one of distinctive features of which is provision made for wet grinding.

H

HAMMERS

Electric. The Electric Hammer, P. Trombetta. Am. Inst. Elec. Engrs., vol. 42, no. 4, Apr. 1922, pp. 297-305, 9 figs. Electric hammer has been studied and developed by writer to point where it seems to show superiority to present-used hammers, in simplicity, safety, running expenses, cost of installation and upkeep, and in many cases in original cost. Development shown is of induction motor type.

HEAT TRANSMISSION

Building Materials. A Study in Heat Transmission with Special Reference to Building Materials, F. C. Houghten. Am. Soc. Heating and Vent. Engrs. Jl., vol. 28, no. 2, Mar. 1922, pp. 151-172, 13 figs. Notes on theory of heat flow; methods of determining heat transmission. Discussion of research work on heat transmission through building and allied materials by various investigations Work of research laboratory.

onduction and Convection. Heat Transfer by Conduction and Convection, W. K. Lewis, W. H. McAdams and T. H. Frost. Am. Soc. Heating and Vent. Engs., Jl., vol. 28, no. 2, Mar. 1922, pp. 97-106, 2 figs. Points out that mass velocity, viscosity and thermal conductivity are major factors in determining coefficient of heat transfer from gases or liquids to solids, and that, for accuracy, heat transfers must be calculated by use of film coefficients, one on each side of heating surface.

HEATING, ELECTRIC

ouses. Limits of Electric House Heating, E. A. Loew. Elec. World, vol. 79, no. 13, Apr. 1, 1922, pp. 623-625, 6 figs. Large scale heating of residences, stores and other establishments in Tacoma shows limits within which electric heating may compete with other heat in mild climates. (Abstract.) University of Wash. Eng. Experiment Station, Bul. no. 15.

HEATING, STEAM

ntral Stations. Mechanical Use of Power in Low-Pressure Steam to Improve the Position of Central Heating Stations (Utilisation mécanique de l'énergie contenue dans la vapeur à très basse pression pour l'amélioration des installations de chauffage central), André Nessi. Bul. de la Société d'Encouragement pour l'Industrie Nationale, vol. 133, no. 10, Dec. 1921, pp. 1322-1366, 31 figs. Use of steam for improving circulation of hot water and hot air, for fans, pumps, etc.

HOUSING

oblem. The National Housing Problem. Am. Soc. Civ. Engrs. Proc. vol. 48, no. 3, Mar. 1922, pp. 476-503, 4 figs. Symposium containing following articles: Property Improvement and Landscaping, Charles W. Leavitt, House Design, Andrew J. Thomas. Certain Aspects of the National Housing Problem: Planning and Zoning, Morris Knowles. Transportation as it Relates to the National Housing Problem, Ernest P. Goodrich. Discussion.

HYDRAULIC TURBINES

iciency Tests. Efficiency Tests of a New Turbine at the Boise Works (Note sur les essais de rendement d'une des nouvelles turbines de l'usine du Bois Noir). A. de Montmollin. Bul. Technique de la Suisse Romande, vol. 48, no. 4, Feb. 18, 1922, pp. 37-40, 2 figs. Results of tests of horizontal axis Francis turbines for Lausanne Electricity Works, showing nearly 90 per cent efficiency at full charge as against 81 per cent guaranteed.

ector, Moody. The Moody Ejector Turbine, S. Logan Kerr. Mech. Eng., vol. 44, no. 4, Apr. 1922, pp. 243-247, 15 figs. Particulars of a turbine for low-head installations which delivers rated horse-power at maximum efficiency when head is a maximum, and also maintains output when head is reduced at flood periods.

HYDROELECTRIC DEVELOPMENTS

Niagara Falls. Increasing Niagara Falls Power Development By 200,000 Hp., G. W. Morrison. Compressed Air Mag., vol. 27, no. 3, Mar. 1922, pp. 65-69, 12 figs. - New Project under construction by Niagara Falls Power Co., requiring driving of a 32-ft. tunnel, a distance of 4,500 ft.

HYDROELECTRIC PLANTS

Caribou, California. High Head Impulse Wheels at New Feather River Plant. Eng. News-Rec., vol. 88, no. 12, Mar. 23, 1922, pp. 472-477, 7 figs. Caribou hydro-electric plant in California has two 30,000-hp. impulse turbines under 1008-ft. head. Water if brought from headwater reservoir by tunnel, river and pipe. Includes article entitled General Features of Design of the Caribou Plant, by Albert A. Northrop; and article on transportation problem in plant construction.

Sand Box. Design of Sand Box for Kern River Hydro-Electric Plant, H. L. Doolittle. Eng. News-Rec., vol. 88, no. 15, Apr. 13, 1922, pp. 616-617, 4 figs. Operation of high-head reaction turbines demands clear water. Test shows 400-ft. tank settles particles passing 200-mesh sieve.

Shawinigan Falls, Canada. Extension to Shawinigan Hydro-Electric Plant, Julian C. Smith. Can. Engr., vol. 42, no. 11, Mar. 14, 1922, pp. 299-306, 15 figs. New 41,000-hp. unit has world's largest steel casing and biggest valve ever built. Foundation stab is 12-ft, thick, 52-ft. space. Paper read before Eng. Inst. Can.

Test Code, A.S.M.E. Test Code for Hydraulic Power Plants and Their Equipment. Mech. Eng., vol. 44 no. 4, Apr. 1922, pp. 248-258, 13 figs. Preliminary draft of the sixth in series of 19 test codes being formulated by A.S.M.E. committee on power test codes.

I

ICE MANUFACTURE

Center-Freeze System. Ice Making by the Center-Freeze System, A. G. Solomon. Power Plant Eng., vol. 26, no. 5, Mar. 1, 1922, pp. 279-281. Five-ton blocks are produced in 30 hr. from raw water.

IMPACT TESTING

Mild Steel. New Tests With Repeated Impact (Nouvelles expériences de chocs répétés), Léon Guillet. Revue de Métallurgie, vol. 18, no. 12, Dec. 1921, pp. 755-757, 1 fig. Describes experiments with various mild steel test bars, showing especially effect of cold working.

INDICATORS

Steam-Engine, Diagram. Why Complete Compression Is Not Economical. Power, vol. 55, no. 13, Mar. 28, 1922, pp. 496-499, 11 figs. Discusses compression line on indicator diagram, showing that compression to initial pressure is not efficient. Describes graphical method of finding proper compression for any given cutoff.

INDUSTRIAL MANAGEMENT

Overhead Distribution. Distributing Overhead to Allow Lower Sales Prices, Walter N. Polakov. Factory, vol. 28, no. 4, Apr. 1922, pp. 400-402, 4 figs. Outlines plan for decreasing costly item of idle machines and men until business comes back.

Production Control. Watching Production from the Office, A. W. Hinkel. Factory, vol. 28, no. 4, Apr. 1922, pp. 416-418, 5 figs. Describes planning department that actually controls production and makes it possible to guarantee date of completion.

Production Costs, Cutting. Cutting Production Coats by Combining Manufacturing Operations, C. B. Barlett. Indus. Management, vol. 63, no. 4, Apr. 1922, pp. 198-200. Account of experience of large company which found that combining manufacturing operations helped materially to eliminate wasted production time.

Production Methods. Modern Production Methods, W. R. Basset. Am. Mach. vol. 56, no. 12, Mar. 23, 1922, pp. 443-445. Administrative methods. Advantages of functional organization; periodical reports save conference time.

Production Planning and Control. The Planning and Control of Production, R. O. Herford. Indus. Administration Jl., vol. 1, no. 9, Jan. 1922, pp. 259-261 (includes discussion). Discusses date, maximum output from a given plant, maximum output from limited capital, maximum output at minimum cost, as factors in control of production; etc.

Routing. How to Study the Routing of Work, Edward H. Tingley. Management Eng., vol. 2, no. 4, Apr. 1922, pp. 209-214, 9 figs. Such analysis is said to be particularly helpful in older plants and those which have expanded rapidly.

Sales Records. Keeping Track of Sales and Distributors, A. H. Tuechter. Am. Mach., vol. 56, no. 15, Apr. 13, 1922, pp. 541-543, 9 figs. Cards and forms for recording sales and shipping data in shop and office. Records to show activities of agents.

INDUSTRIAL RELATIONS

Antagonism of Capital and Labor. The Inevitable Antagonism Between Employers and Employees. Management Eng., vol. 2, no. 4, Apr. 1922, pp. 233-236. Discussion of C. E. Knoeppel's article in March issue of same journal.

INJECTORS

Principle and Application. Practical Information About Injectors, Terrell Croft. Power, vol. 55, no. 12, Mar. 21, 1922, pp. 460-463, 11 figs. How different types work; advantages and disadvantages; applications; testing; selection; how to overcome operating troubles.

INSULATING MATERIALS

Electric Strength, Heat Effect on. The Effect of Heat on the Electric Strength of Some Commercial Insulating Materials, W. S. Flight. Instn. Elec. Engrs. Jl., vol. 60, no. 306, Feb. 1922, pp. 218-235, 26 figs. Results of investigation to ascertain variation in electric strength between temperatures of 30 and 100 deg. Cent. of many of the solid insulating materials at present employed in manufacture of electrical machinery.

Solid Dielectric Strength of. The Dielectric Strength of Solid Insulating Materials, W. S. Flight, Elec. Rev. (Lond.), vol. 90, nos. 2303 and 2304, Jan. 13 and 20, 1922, pp. 39-41 and 76-79, 21 figs. Factors which influence dielectric strength. Discusses advisability of formulating standard sets of rules for conducting dielectric strength tests, and makes recommendations.

COMBINED COMPRESSED-AIR AND. Possibilities of Combined Internal-Combustion and Compressed Air Engines, R. W. Robinson. Practical Engr., vol. 65, no. 1828, Mar. 9, 1922, pp. 148-149. Describes design of prime mover which will combine outstanding advantages of steam engine with those of internal-combustion engine and, as far as possible, eliminate disadvantages of both, to produce engine of greater thermal efficiency than present internal-combustion engine. From paper read before Inst. Mar. Engrs.

EFFICIENCY. Efficiency of Internal-Combustion Engines (Rendement organique des moteurs à combustion interne), André Planiol. Comptes Rendus des Séances de l'Académie des Sciences, vol. 174, no. 10, Mar. 6, 1922, pp. 663-666. Discusses losses by friction as a criterion by which to judge mechanical quality of engine and describes new method of measuring friction losses.

ELASTIC. Elastic Internal-Combustion Engines (Elastische Verbrennungsmotoren), Aurel Persu. Motor-wagen, vol. 25, no. 8, Mar. 20, 1922, pp. 153-158, 8 figs. Deals with increasing limit of elasticity of engines without changing volume of cylinder that is, for ordinary engines with constant stroke.

See also Airplane Engines; Automobile Engines; Diesel Engines; Gas Engines, Marine Engines, Still; Oil Engines.]

IRON

ELECTROLYTIC. Commercial Pure Iron and the "Direct Process", Bradley Stoughton. Chem. Age (N.Y.), vol. 30, no. 3, Mar. 1922, pp. 131-133, 4 figs. Discusses electrolytic iron, its production, and properties.

IRON CASTINGS

GRAY. The Problem of Grey Iron Castings, H. J. Young. Foundry Trade Jl., vol. 24, nos. 279 and 280, Dec. 22 and 29, 1921, pp. 497-501 and 511-514, 19 figs. Composition of pig iron; possibilities of standard castings; turbine castings; duplexing; importance of graphite; test-bars; influence of phosphorus; sulphur-manganese balance versus silicon control; absence of standard composition in internal-combustion engines. Paper read before Inst. Min. Engrs.

IRON ORE

EUROPE. Iron-Ore Resources of Europe, Max. Roesler. Iron & Coal Trades Rev., vol. 104, no. 2817, Feb. 24, 1922, pp. 266-268, 3 figs. Geologic distribution; production and consumption; comparison of continents. From U.S. Geological Survey, Bul. 706.

MAGNETIC CONCENTRATION. Magnetic Roasting of Iron Ores, W. W. Davis. Iron Trade Rev., vol. 70, no. 14, Apr. 6, 1922, pp. 968-973, 5 figs. Notes on what has been and can be done on commercial scale, in converting hematite to magnetite for magnetic separation, and probable cost of process. (Abstract.) Bul. University of Minnesota.

TITANIFEROUS. A Method of Smelting Titaniferous Iron Ore, W. M. Goodwin. Honorary Advisory Council for Sci. and Indus. Research, Dominion of Can. Report no. 8, 1921, 25 pp., 4 figs. Describes attempt being made to provide economic use for iron ore present in abundance in central Canada and in other parts of world, and now of no industrial importance.

IRON, PIG

SYNTHETIC. Producing Synthetic Pig Irons, Charles-Albert Keller. Iron Trade Rev., vol. 70, no. 15, Apr. 13, 1922, pp. 1044-1045. By properly selecting scrap and manipulating furnace a wide range of steelmaking and foundry irons can be made. Large furnaces are recommended. Chemical control essential. (Abstract.) Paper presented at foundry congress at Liege, Belgium.

IRRIGATION

CONCRETE-LINED CANALS. Thin Concrete Lining Successful in Irrigation Canals, R. C. E. Weber. Eng. News-Rec., vol. 88, no. 11, Mar. 16, 1922, pp. 436-437, 3 figs. Canal lining, 1½ in. thick, placed on 64 mi. of main distribution system of Orland Project of U.S. Reclamation Service at cost of 39 cts. per sq. yd., saves 60 per cent in maintenance and permits less seepage than earth construction.

STRUCTURE DESIGN, ACTUARIAL FACTORS IN. Actuarial Factors in the Design of Irrigation Structures, H. B. Muckleston. Eng. Jl. (Eng. Inst. Can.), vol. 5, no. 4, Apr. 1922, pp. 193-197. Economics and storage works; value of storage, available storage, capacity in relation to dam height and cost, storage capacity.

J

JIGS

STANDARDIZATION OF FIXTURES AND. Standardization of Jig and Fixture Design. Machy. (N.Y.), vol. 28, no. 8, Apr. 1922, pp. 610-613, 5 figs. Discusses use of standardized parts, such as shoulder screws fixture keys, shoulder drill bushings, binder handles, etc.

L

LATHES

TURRET. The Herbert No. 11 Bar Turret Lathe. Machy. (Lond.), vol. 19, no. 491, Feb. 23, 1922, pp. 637-638, 3 figs. Describes lathe by Alfred Herbert, Ltd., Coventry, in which possibilities of danger, damage and wear have been reduced to a minimum.

LIFTING MAGNETS

APPLICATIONS. The Use of Electromagnets for the Lifting of Loads (Der Elektromagnet als zeitgemässes Hilfsmittel beim Heben von Lasten), H. Wintermeyer. Fordertechnik u. Frachtverkehr, vol. 15, no. 6, Mar. 17, 1922, pp. 81-84, 7 figs. Examples of various possible applications of lifting magnets. Special constructions of coil and magnet case. Transmission of current to magnet.

LIGHTING

COMMITTEE REPORT. Illumination Items. Am. Inst. Elec. Engrs. Jl., vol. 41, no. 4, Apr. 1922, pp. 278-280, 3 figs. Report of Lighting and Illumination Committee on highway lighting, textile-mill lihgting standards, elixit devices, and color temperature and its relation to quality of light.

INDUSTRIAL PLANTS, CODE FOR. Tentative Lighting Code. Textile World, vol. 41, no. 13, Apr. 1, 1922, pp. 79, 115 and 117. Rules and regulations made by Mass. Dept. of Labor and Industries for lighting industrial establishments.

LIGHTNING ARRESTERS

TYPES. Lightning Arresters, V. E. Johnson. Power Plant Eng., vol. 25, nos. 21 and 23, Nov. 1 and Dec. 1, 1921, pp. 1053-1058 and 1148-1152, 33 figs. Discussion of operating characteristics of various types of lightning arresters and considerations which govern their selection.

LIGNITE

BRIQUETTING PLANT. The Lignite Briquetting Plant, Bienfait, Sask., E. R. Woodward, Jr., Eng. Jl. (Eng. Inst. Can.), vol. 5, no. 4, Apr. 1922, pp., 185-192, 5 figs. Importance of developing lignite as commercial fuel in Western Canada; research work by Lignite Board; details of experimental work.

LOCKS

MOVABLE DAMS AND. Some Notes on the Location and Construction of Locks and Movable Dams on the Ohio River, with Particular Reference to Ohio River Dam No. 18, Thomas P. Roberts. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 3, Mar. 1921, pp. 731-736. Discussion of paper by William M. Hall published in Proceedings, Jan. 1922.

LOCOMOTIVE BOILERS

SEAMS, CALCULATING EFFICIENCY OF. Calculating the Efficiency of Boiler Seams, R. J. Finch. Ry. Mech. Engr., vol. 96, no. 4, Apr. 1922, pp. 193-196, 5 figs. Explains use of two tables which facilitate work and reduce chance for error; places where failure is likely to occur.

TUBES. Installing and Maintaining Charcoal Iron Lcoomotive Boiler Tubes, G. H. Woodroffe and C. E. Lester. Boiler Maker, vol. 22, no. 3, Mar. 1922, pp. 61-65, 20 figs. Makes recommendations regarding application of body tubes, superheater flues, and arch tubes. See also Ry. Mach. Engr., vol. 96, no. 4, Apr. 1922, pp. 221-225, 20 figs.

WELDING. Expert Report on Locomotive Boiler Welding — Details of Approved Methods of Selecting Material and Perfecting Repairs. Ry. & Locomotive Eng., vol. 35, no. 3, Mar. 1922, pp. 62-64, 19 figs.

LOCOMOTIVES

BRITISH AND AMERICAN DESIGN. British and American Locomotive Design and Practice, P. C. Dewhurst. Engineering, vol. 113, nos. 2934 and 2935, Mar. 24 and 31, 1922, pp. 373-377 and 405-408, 11 figs. Some comparative comments thereon from practical experience. Paper read before British Instn. Mech. Eng.

COUNTERBALANCING RECIPROCATING MASSES. The Development of Counterbalancing in British Locomotive Practice, F. W. Brewer. Engineer, vol. 133, no. 3455, Mar. 17, 1922, pp. 298 and 300. History of development down to present-day practice.

DIESEL-ENGINES. Possibilities of the Diesel Locomotive. Ry. Mech. Engr., vol. 96, no. 3, Mar. 1922, pp. 120-121. Editorial note. Disadvantages of Diesel engine for locomotive service.

ELECTRIC. *See Electric Locomotives.*

4-8-2 AND 2-10-2- TYPES. New Mountain Type and Santa Fe Type Locomotives for the Manila Railroad. Ry. & Locomotive Eng., vol. 35, no. 3, Mar. 1922, pp. 55-56, 2 figs. Describes 4-8-2 type, with tractive effort of 28,600 lb., for passenger service, and 2-10-2 type, with tractive effort of 35,700 lb., for freight service.

LUBRICANTS

PARAFFIN SERIES. Boundary Lubrication — The Paraffin Series, W. B. Hardy and Ida Doubleday. Royal Soc. Proc., vol. 100, no. A 707, Mar. 1, 1922, pp. 550-574, 5 figs. Results of experiments, and theory. Lubricating qualities of normal paraffins and their related acids and alcohols; influence of quantity of lubricant; solid lubricants; influence of chemical constitution.

TESTING APPARATUS. A Proposed Method for Solving Some Problems in Lubrication. William Stone. Commonwealth Engr., vol. 9, nos. 4 and 5, Nov. 1 and Dec. 1, 1921, pp. 115-122 and 139-149, 13 figs. Describes method of testing and construction of apparatus employed to determine conditions of formation and stability of lubricating film and effect of variations of viscosity in different parts of film due to varying temperatures. Results of tests carried out.

LUBRICATING OILS

AUTOMOTIVE-ENGINE, DILUTION OF. The Dilution of Lubricating Oil in the Present Automotive Engine, William F. Parish. Sci. Lubrication, vol. 2, no. 1, Jan. 1922, pp. 5-7 and 21. Dilution through decomposition of oil; leakages of raw gasoline; leakages during compression stroke; extent to which dilution exists; results of dilution; wear; etc. Paper read before combined meeting of Am. Petroleum Inst., Soc. Automotive Engrs., and Nat. Automobile Chamber of Commerce.

COMPOUNDING. Compounding of Lubricating Oils, W. F. Osborne. Power, vol. 55, no. 14, Apr. 4, 1922, pp. 535-536. Points out that for steam-engine cylinders and marine-engine lubrication compounding is essential. On other hand, a pure mineral oil should be used where there is any danger of water causing emulsion.

EMULSIONS. The Cause of Emulsions in Lubricating Oils, W. F. Osborne. Power vol. 55, no. 13, Mar. 28, 1922, pp. 502-503. Notes on separation of water and oil; impurities in oil; effect of compounding.

STEAM CYLINDERS. Compounded Cylinder Oil for Superheated Steam Conditions. Lubrication, vol. 8, no. 1, Jan. 1922, p. 9. Recommends use of medium-heavy viscosity cylinder oil, having about 4 or 5 per cent of animal oil.

STEAM-TURBINE. Keeping Steam Turbine Lubricating Oil in Good Condition, Charles H. Bromley. Sci. Lubrication, vol. 1, no. 12, Dec. 1921, pp. 5-11, 7 figs. Lubrication trend in turbine practice; turbine oil circulating systems; formation of emulsion and sludge; acidity; continuous by-pass system; requirements of efficient oil filter for purifying steam turbine oil; etc. Reprinted from Gen. Elec. Rev.

SUBSTITUTES. Lubricants and Their Substitutes (Ueber Schmiermittel und deren Ersatzstoffe), Bruno Simmersbach. Wärme- u. Kälte-Technik, vol. 24, no. 5, Mar. 1, 1922, pp. 53-56. Experience in Germany with substitute oils.

LUBRICATION

LUBRICANTS AND. Lubrication and Lubricants. Sibley Jl. of Eng., vol. 36, no. 2 Feb. 1922, pp. 18-29 and 37, 7 figs. Discusses loss of friction, viscosity of lubricants, laws of lubrication, etc.

THEORY. Theory of Lubrication, William F. Parish. Sci. Lubrication, vol. 1, no. 11, Nov. 1921, pp. 15-19. Discusses the two functions of a lubricant, keeping surfaces apart, and conveying heat from surfaces that is caused by friction.

M

MACHINE SHOPS

High-Speed Production. Examples of Modern High Speed Production, H. A. Wilson. Can. Machy., vol. 27, no. 7, Feb. 16, 1922, pp. 27-30, 11 figs. Methods adopted at Ford motor plant.

MACHINE TOOLS

Bearings, Adjustments of. The Adjustment of Machine Tool Bearings, Fred Horner. Machinery (Lond.), vol. 19, nos. 484 and 483, Dec. 22 and 29, 1921, pp. 342-347, 385-387, 53 figs. Discusses divided, solid, and tapered bearings, and gives a number of examples of their adjustments, contraction of parallel bushings; capped bearings; end adjustments.

MAGNETIC FLUX

Distribution in Transformers. Magnetic Flux Distribution in Transformers, Paul B. McEachron. Am. Inst. Elec. Engrs. Jl., vol. 41, no. 4, Apr. 1922, pp. 281-287, 10 figs. Data are secured concerning magnitudes and phase positions of fluxes in different sections of core. Results show that leakage fluxes do not exist as separate fluxes in core.

MALLEABLE IRON

Manufacture. Progress in Manufacture of Malleable Iron, Enrique Touxeda. Can. Foundryman, vol. 13, no. 3, Mar. 1922, pp. 32-34. Air-furnace thermal efficiency; proportioning air supply; use of waste-heat boilers; design of double-hearth furnaces; use of coke-oven gas; etc.

MEASURING INSTRUMENTS

Accuracy. The Accuracy of Measuring Instruments (Genauigkeiten der Messzeuge), R. P. Schröder. Betrieb, vol. 4, no. 9, Feb. 11, 1922, pp. 269-274. Notes on gage blocks, initial comparative, trial and working gages. Measurement of workpieces.

Optical Equipment. Optical Auxiliary Equipment for Measuring Instruments (Optische Hilfsmittel an Messgeräten), Walter Block. Betrieb, vol. 4, no. 9, Feb. 11, 1922, pp. 285-289, 6 figs. Discusses optical media for measuring instruments of all kinds, but especially those used in machine construction, for purpose of manipulating them with greater ease and accuracy.

METALS

Grain Growth and Recrystallization. Grain Growth and Recrystallization in Metals, Zay Jeffries and R. S. Archer. Chem. & Met. Eng., vol. 26, nos. 8, 9 and 10, Feb. 22, Mar. 1 and 8, 1922, pp. 343-345, 402-410 and 449-457, 30 figs. Feb. 22: Technical definition of recrystallization, and list of recrystallization temperatures for common metals. Methods for measuring grain size, shape and volume. Mar. 1: Effect of time and temperature of heating, degree of cold-work, original grain size and obstructing impurities on grain growth of metals and solid solution alloys. Mar. 8; Possible causes of grain growth; recrystallization is grain growth of fragmented crystals; germination ; formation of nuclei.

Mechanical Properties of. Variation of Mechanical Properties in Metals and Alloys at Low Temperatures (Sur la variation des propriétés mécaniques des métaux at alliages aux basses températures), Léon Guillet and Jean Cournot. Comptes rendus des Séances de l'Académie des Sciences, vol. 174, no. 6, Feb. 6, 1922, pp. 384-386. Experiments with a number of metals; table of Brinell hardness and resiliency of these at + 20 deg., — 20 deg.,—80 deg. and liquid-air temperatures.

Strength and Fatigue. Calculation of a Non-circular Cylindrical Envelope (Méthode générale de calcul des enveloppes cylindriques à section non circulaire), P. Cayere. Houille Blanche, vol. 20, nso. 59-60, Nov.-Dec., 1921, pp. 213-216, 5 figs. Discusses interior pressure, fatigue of metals, etc.

Tensile Strength of Plastic. Tensile Strength (Verfestigung und Zugfestigkeit), Freidrick Körber, Stahl u. Eisen, vol. 42, no. 10, Mar. 9, 1922, pp. 365-370, 8 figs. The mechanics of tensile test of plastic metals. Notes on calculation of tensile strength from curve of true stresses. Theory that slip and rotation of crystal elements takes place is confirmed.

METEOROLOGY

Wind, Velocity of. Variation of Velocity of Wind With Altitude (La variation de la vitesse du vent avec l'altitude), Ch. Maurain. Revue Générale des Sciences, vol. 33, no. 3, Feb. 15, 1922, pp. 76-80, 5 figs. Discusses results obtained by means of recording balloons and gives comparative curves.

MILLING MACHINES

Vertical. The "Relmil" Vertical Milling Attachment. Machinery (Lond.), vol. 19, no. 493, Mar. 9, 1922, p. 699, 2 figs. Distinguishing feature is that it does not clamp or fix on lathe saddle. Is secured to back of lathe bed and also to chip tray by means of two substantial cast-iron brackets.

MINES

Power-Distributing System. Power Distributing System for Deep Metal Mines, C. D. Woodward. Am. Inst. Min. & Met. Engrs. Trans., no. 1121-M, Feb. 1922, 10 pp. 10 figs. Purchased power is delivered, over duplicate feeders, in form of 60 cycle, 2400 volt, three-phase current, to five compressor plants, where most of energy is used for driving air compressors.

MOLDING

Plastic and Powdered Substances. Moulding Plastic and Powdered Substances (including Casting Substances other than Metals and Presses, Mechanical). Abridgments of Specifications, class 87 (ii), 1922, 379 pp. Patent's for nventions for period 1909-15.

MOLDING METHODS

Boxes. A New System in Moulding-Boxes. Mech. World, vol. 71, no. 1835, Mar. 3, 1922, p. 161. Describes box having separate ends and sides, secured by a pin and two wedges, of opposed bevel, at each joint. System has proved very satisfactory in sizes from 16 in. sq. to 80 in. sq. Translated from Giesserei-Zeitung.

MOLYBDENUM

Production Processes. The Recovery, Treatment and Utilization of Molybdenum Ore and the Production of Ferro-Molybdenum (Die Gewinnung, Verarbeitung and Verwertung des Molybdänglanzes, sowie die Herstellung des Ferromolybdäns), H. Mehren Edel-Erden u.-Erze, vol. 3, nos. 5-6 and 7-8, Dec. 1921 and Jan. 1922, pp. 25-26 and 39-40. Review of foreign and domestic processes.

MONEL METAL

Water Works, Suitability for. Monel Metal and Its Suitability for Water-Works Use, H. S. Arnold. N. E. Water Works Assn. Jl., vol. 36, no. 1, Mar. 1922, pp. 86-93 and (discussion) pp. 93-94. Describes source of supply and method of manufacture. Physical properties and uses.

MOTION-PICTURE PHOTOGRAPHY

Technical Applications. The Application of Photography in Engineering. (Die Anwendung der Photographie in der Technik), R. Thun. Betrieb, vol. 4, no. 8, Jan. 28, 1922, pp. 252-257, 12 figs. Examples of use of photography and motion-picture photography for observation, research and measuring.

MOTORSHIPS

Single- and Twin-Screw. Comparison Between Single and Twin-Screw Motor Ships, H. Blache. Shipbldg. & Shipg. Rec., vol. 18, nos. 19 and 20, Nov. 10 and 17, 1921, pp. 607-609 and 639-641, 4 figs. Nov. 10: Discusses different problems in connection with Diesel engines for ships, especially those of Burmeister & Wain's make. Heavy and light oil fuel; working reliability; ratio of cylinder diameter and stroke; trial data. Nov. 17: Propeller efficiency; trial results; new thrust bolck; cargo space; deciding factors.

3,000-hp. Single-Screw. 3,000 Horsepower Single Screw Motorship. Mar. Eng., vol. 27, no. 4, Apr. 1922, pp. 237-239, 3 figs. Describes the Dominion Miller, built for Furness, Withy & Co.; Doxford engines; 9,400 tons deadweight; boiler oil proposed as fuel.

MOTOR-TRUCK TRANSPORTATION

Graphical Control. A Graphical Control of Motor Truck Transportation. Howell B. May. Factory, vol. 28, no. 4, Apr. 1922, pp. 410-412, 3 figs. Describes graphical planning and recording system which it is claimed, makes it possible to realize greatest number of productive minutes out of total 480 that struck is out of garage.

MOTOR TRUCKS

Tipping Gear. Gravity-Type Tipping Gear for Motor Wagons. Engineering, vol. 113, no. 2934, Mar. 24, 1922, p. 358, 3 figs. With described gear center of gravity of load during tipping operation moves along a straight line, with slight downward slope towards rear end of wagon.

O

OIL ENGINES

Combustion. Combustion Progress in Oil Engines (Der Verbrennungsvorgang im Oelmotor), Constantin Redzich. Wärme-u. Kälte-Technik, vol. 24, no. 2, Jan. 15, 1922, pp. 17-18. Review and discussion of scientific investigations.

OIL FUELS

Boilers for. Liquid Fuel For Steam Boilers (L'Emploi des combustibles liquides pour le chauffage des foyers industriels et particulièrement des chaudières à vapeur), Louis Cauchois. Bul. des Associations Françaises de Propriétaires d'Appareils à Vapeur, no. 2, Oct. 1920, pp. 37-68, 6 figs. Properties of combustible liquids and precautions necessary in handling, including petroleum and its derivations, shale oil, alcohol, etc. Burners of various types.

Heavy, in Carburetor. The Use of Heavy Oil Fuels in Carburetors (Zur Frage der Verwendung schwerer Brennstoffe in der Vergasermaschine), J. Plünzke. Motorwagen, vol. 25, no. 7, Mar. 10, 1922, pp. 125- 127, 5 figs. Determination of boiling curve for two fuels, naphthalene and anthracene, during suction and compression.

Internal-Combustion-Engine. Interna-Combustion Engine Fuels, C. A. Norman. Soc. Automotive Engrs. Jl., vol. 10, no. 3, Mar. 1922, pp. 187-192 and (discussion 192 and 203. Discusses use of kerosene and gasoline, and substitute fuels, including shale oils.

Steam Power. Fuel Oil For Steam Power, A. D. White, Combustion, vol. 6, no. 4, Apr. 1922, pp. 175-176, 1 fig. Advantages of fuel oil over coal; conditions for efficiency; controlling steam supply; preheating of oil.

OIL SHALES

Activities, 1921. Oil Shale — A Resume for 1921, Victor C. Alderson. Petroleum Times, vol. 7, no. 164, Feb. 25, 1922, pp. 259-261. Reviews activities in Utah, Colorado, Canada, Kentucky, Esthonia, Tasmania, and other places.

Destructive Distillation. Some Factors Affecting the Products of the Destructive Distillation of Oil Shales, Lewis C. Karrick. Chem. Age. (N.Y.), vol. 30, no. 3, Mar. 1922, pp. 112-114, 1 fig. Structure of oil shale and its influence on distillation products; effect of temperature lag; and rate of heat supply. Based on data obtained by investigations of U.S. Bur. Mines.

Treating Method. New Method of Treating Oil Shales. Petroleum Times, vol. 7, no. 164, Feb. 25, 1922, p. 262. Describes recent British patent granted to S. H. Dolbear of San Francisco, object of which is the separation of valuable organic compounds in shale from waste or gangue which produces no oil.

OPEN-HEARTH FURNACES

Design. Design of Open-Hearth Furnaces, A. D. Williams. Iron Age, vol. 109, nos. 13 and 17, Mar. 16 and 30, 1922, pp. 717-719, 1 fig. and 853-855, 2 figs. Mar. 16: Regenerator computations for volume and weight of checker work required. Temperature changes based on time reversals. Mar. 30: Regenerator and flue calculations for frictional resistance to passage of air and gases. Summation of losses.

Fluorspar, Use of. Fluorspar in Open-Hearth Practice. Iron Age, vol. 109, no. 11, Mar. 23, 1922, pp. 783-784. Effective agent in removing sulphur from steel. Action on slag and furnace lining. Old ideas altered. Translated from article by S. Schleicher in Stahl u. Eisen, Mar. 17, 1921.

German. Arrangement of Open-Hearths in Germany, Hubert Hermanns. Blast Furnace & Steel Plant, vol. 10, no. 3, Mar. 1922, pp. 192-194, 3 figs. Steelmakers of Germany have not adopted water-cooled parts, but use detachable posts; arrangement of gas and air chambers is of special interest.

ORES

VALUATION. Notes on the Valuation of Ores, Concentrates and Smelter Products, L. C. Stuckey. Instn. Min. and Metallurgy Bul., no. 210, Mar. 1922, pp. 1-34, 2 figs. Notes on valuation of gold, copper, lead, zinc and tin ores, aluminum and bauxite and ores used for iron and steel. Bibliography.

ORE DRESSING

BALL MILLS. The Power-Load Curves of Ball Mills, A. O. Gates. Eng. & Min. Jl., vol. 113, no. 12, Mar. 25, 1922, pp. 485-487, 2 figs. Describes simple laboratory apparatus for experimental work and discusses power consumption.

TUBE MILLING. Artificial Pebbles For Tube-Milling, A. W. Allen. Min. & Sci. Press, vol. 124, no. 12, Mar. 25, 1922, pp. 405-409, 6 figs. Tests as to hardness, toughness, and abrasion; preparation of rock for tube-milling purposes.

OVERVOLTAGES

CAUSES. The Compensation Phenomena Occurring with Disconnection of Inductivities (Especially by Means of Oil-Break Switches) (Ueber Ausgleichsvorgänge beim Abschalten von Induktivitäten (insbesonders vermittelst Oelschalter), Paul Hammerschmidt. Archiv för Elektrotechnik, vol. 10, no. 12, Mar. 6, 1922, pp. 431-455, 58 figs. Investigation to determine causes of overvoltages occurring with the switching off of asynchronous motors and transformers running on no load.

OXY-ACETYLENE CUTTING

CAST IRON. Cutting Cast Iron With the Oxyacetylene Torch, Alfred S. Kensey. Stevens Indicator, vol. 38, no. 4, Oct. 1921, pp. 28[illegible]296, 5 figs. Reviews progress made with oxyacetylene torch; how to cut cast iron; effects of oxyacetylene cutting on cast iron; advantages; theory of cutting of metals by gas.

OXY-ACETYLENE WELDING

INSTRUCTION SHEET. Proposals for New Factory Instruction Sheets (Entwürfe neuer Betriebsblätter). Betrieb, vol. 3, no. 11, Mar. 4, 1922, pp. 39-40. Proposals of Works Dept. of German Federation of Technical and Scientific Societies for care and manipulation of gas-welding equipment.

RODS FOR. Choosing Rods for Welding Work, J. R. Dawson. Iron Trade Rev., vol. 70, no. 15, Apr. 13, 1922, pp. 1033-1036 and 1043, 10 figs. Selection of welding rod for oxy-acetylene process depends on service requirements of finished weld. Inspection of rods and tests of welds aid in determining choice of materials. (Abstract.) Paper delivered before Int. Acetylene Assn.

SAFETY IN. Safety Engineering as Applied to Oxy-Acetylene Cutting and Welding Apparatus, F. J. Napolitan. Am. Welding Soc. Jl., Vol. 1, no. 2. Feb. 1922, pp. 13-30, 3 figs. Writer emphasizes safety of modern acetylene generators. Discusses acetylene and its generation; explosive mixtures; portable acetylene cylinders and oxygen cylinders; high-pressure gages; torches and tips; flashbacks; etc.

P

PAPER MANUFACTURE

TAR PAPER. Tar Paper (Le carton bitumé), J. Tricard. Arts et métiers, vol. 74, no. 10, July 1921, pp. 216-218, 7 figs. Discusses manufacture which has been developed during the war, to supply quick and cheap protection in inclement weather.

PLASTIC MATERIALS

PLASTIC WOOD. Plastic Wood, Engineer, vol. 133, no. 3453, Mar. 3, 1922, pp. 230-231. Describes material like soft wood, but without grain having cellulose nitrate as a base, chief raw material being cotton. It has consistency of dough used in pastry making and can be molded into any conceivable form; it can be used for patching up patterns and rounding off fillets and in molding process for making small articles. Process of manufacture.

PLATINUM

OCCURRENCE IN QUARTZ VEINS. Platinum in Quartz Veins, Henry W. Turner. Eng. and Min. Jl., vol. 113, no. 12, Mar. 25, 1922. pp. 488-489. Occurrences noted in California, Brazil, British Columbia, New Zealand, Ural. Mts., and Colombia.

POLES, CONCRETE

TRANSMISSION LINE. An Electric Transmission Line Supported by Reinforced Concrete Poles in Sweden. (Eine Kraftleitung auf Stahlbewehrten Betonschleudermasten in Schweden), M. Foerster. Bauingenieur, vol. 3, no. 4, Feb. 28, 1922, pp. 104-107, 9 figs. Describes poles delivered by German firm, and method of transportation.

PORCELAIN

ELECTRICAL, RESEARCH. Electrical Porcelain Research, M. H. Hunt. Elec. Jl., vol. 19, no. 3, Mar. 1922, pp. 94-96, 6 figs. Describes porcelain laboratory equipped with apparatus necessary for forming, drying, glazing and firing of test pieces, and full size insulators. Discusses ingredients of porcelain composition; etc.

POWER PLANTS

BRITISH PRACTICE. Notes on British Power Plant Practice, C. H. S. Tupholme. Power Plant Eng., vol. 26, no. 6, Mar. 15, 1922, pp. 315-319. Efforts directed by engineers toward securing higher fuel economy, due to continued high prices of fuel.

DESIGN. Developments in Power Station Design. Engineer, vol. 133, no. 3455, Mar. 17, 1922, pp. 290-292, 10 figs. partly on p. 302. Describes cooling towers Powell Duffryn Steam Coal Co. built by Davenport Engineering Co., each designed to reduce temperature of 216,000 gal. of water per hr. from 100 deg. Fahr. under average atmospheric conditions: turbine-driven feed pump; coal and ash-handling plant; etc.

POWER TRANSMISSION

OIL VARIABLE GEAR. Power Transmission by Oil (Elaulic Gear), H. S. Hele-Shaw. Instn. Mech. Engrs. Proc., no. 7, 1921, pp. 843-873, 16 figs. Author discusses power transmission when it is accompanied with its transformation, and where oil is employed as working agent. Design and applications of oil variable gear, or elaulic gear.

PRESSES

FORGING, STEAM-HYDRAULIC. Steam-Hydraulic Forging Presses (Les presses vapohydrauliques à forger). Outillage, vol. 249, no. 9, Mar. 4, 1922, pp. 271-273, 6 figs. Describes hydraulic presses in which high-water pressure is produced by steam compressor.

PRESSURE VESSELS

MECHANICALLY WELDED. The Strength of Mechanically Welded Pressure Containers, R. J. Roark. Mech. Eng., vol. 44, no. 4, Apr. 1922, pp. 225-230, 18 figs. Describes pressure tests made on electrically welded, gas-welded, and riveted pressure containers, and tension and shear tests made on specimens of welded metal, carried out for purpose of demonstrating strength and uniformity of construction in which electric weld is employed.

PRODUCER GAS

CLEANING WITHOUT WASHING. Cleaning Producer Gas Without Washing, James H. Matheson. Iron Age, vol. 109, no. 14, Apr. 6, 1922, pp. 916-917, 4 figs. Gas equalizer and soot collector developed to treat gas from bituminous coal.

FURNACE WORK. Producer Gas for Furnace Work. Engineering, vol. 113, no. 2934, Mar. 24, 1922, pp. 347-351, 34 figs. partly on supp. plate. Describes low-temperature rotary carbonization plant devised by Harald Nielsen, consisting essentially of combination of ordinary producer with low-temperature carbonizing retort, in which partial distillation of raw coal is effected by sensible heat of producer gas. Designed to improve efficiency of manufacture of producer gas, and permit recovery of valuable by-products.

PULVERIZED COAL

SYSTEMS OF BURNING. Burning Pulverized Fuel—V, F. P. Coffin. Combustion, vol. 6, no. 4, Apr. 1922, pp. 181-184, 2 figs. Discusses conditions of efficient combustion, tube slag, effect of furnace temperature on ash, baffling of horizontal water-tube boilers, and describes some recent installations. Excerpts from author's contribution on "The Utilization of Coal on a Multiple-Product Basis" to Bacon and Hamor's "American Fuels".

PUMPING PLANTS

DIESEL-DRIVEN. Diesel-Driven Pumping Plant for Trinidad. Engineer, vol. 133, no. 3453, Mar. 3, 1922, p. 248, 3 figs. partly on p. 242. Describes treble-ram pump for Trinidad, with capacity of 76,000 gal. per hr. when running at 44 r.p.m. and with head of 350 ft. Pump is driven by means of 200-hp. Diesel engine of four-cylinder, four-cycle pattern.

PUMPS

COAL MINES. Pumping Systems for Coal Mining, M. C. Benedict. Coal Industry, vol. 5, no. 2, Feb. 1922, pp. 106-108. Drainage ditches in place of pumps; best types of pumps for various classes of work.

HIGH-LIFT TURBINE. High Lift Turbine Pumps, A. M. Attack. So. African Instn. Engrs. Jl., vol. 20, no. 7, Feb. 1922, pp. 130-145 and (discussion) 145-146, 19 figs. Discusses some of the more important features upon which a successful design will depend, including multi-stage and centrifugal pumps, pumps in series, axial thrust, pumps driven by synchronous motors, sinking pumps, impellers, diffuser, etc.

JETS, IMPACT LOSSES OF. Impact Losses of Jets, J. B. Burnell. Engineering, vol. 113, no. 2935, Mar. 31, 1922, pp. 404-405, 4 figs. Account of experiments made by author to determine loss of kinetic energy in jet due to varying deviation, and friction losses in bends. (Abstract.) Paper read before Melbourne Division of Instn. Engrs., Australia.

PIPE EFFICIENCY. Pipe Friction and Pump Efficiency, William Brazenall. Colliery Guardian, vol. 123, no. 3191, Feb. 24, 1922, pp. 472-473. Results of experiments carried out with turbine, three-throw ram, and differential ram pumps. (Abstract.) Paper read before Min. Inst. of Scotland.

PUMPS CENTRIFUGAL

TYPES AND OPERATION. Centrifugal Pumps, J. W. Rogers. Eng. Rev., vol. 35, nos. 8 and 9, Feb. and Mar. 1922, pp. 259-262 and 296-301, 12 figs. Feb.: Advantages, principles, operating characteristics, efficiency and regulation, power requirement, electric motors. Mar.: Describes some modern types.

Q

QUAYS

DEEP-WATER. Deep-Water Quays, Ernest Latham. Engineering, vol. 113, no. 2935, Mar. 31, 1922, pp. 380-384, 9 figs. Deals with reinforced-concrete and timber jetties and wharves in the Thames. Based on experience, writer has formed conclusion that, under post-war conditions, reinforced concrete is not always most suitable type of construction for deep-water tidal berths.

R

RADIOACTIVITY

DEVELOPMENT. Radio-Activity, Ernest Rutherford. Engineering, vol. 113, nos. 2932, 2933, 2934 and 2935, Mar. 10, 17, 24 and 31, 1922, pp. 299-300, 331-332, 365-366 and 386-387, 25 figs. Review of development; resting of radium, its characteristics and uses. Behavior of radioactive elements. Radium emanation; origin of radium. Abstracts of four lectures delivered before British Roy. Instn.

RADIOTELEGRAPHY

HIGH-SPEED. High-Speed Wireless Telegraphy. Instn. Elec. Engrs. Jl., vol. 60, no. 306, Feb. 1922, pp. 245-255 and (discussion) 255-262, 16 figs. Discusses experimental progress directed towards mechanicalization of wireless telegraphy in as simple and portable a form as possible.

POULSEN ARC. Some Improvements in the Poulsen Arc—I, P. O. Pedersen. Inst. Radio Engrs. Proc., vol. 9, no. 5, Oct. 1921, pp. 434-441, 6 figs. Shows operation of Poulsen arc with only one voltage peak per period is desirable. Describes suitable cathode cooling shoe for one-peak operation.

RAILS

HEAD, CONDITIONS AFFECTING. Conditions Affecting the Head of a Rail, James E. Howard. Eng. & Contracting, vol. 57, no. 11, Mar. 15, 1922, pp. 252-253. Review of destructive influences. Paper presented before N. Y. R. R. Club.

RAILWAY CONSTRUCTION

SPECIFICATIONS. American Railway Engineering Convention. Eng. News-Rec., vol. 88, no. 12, Mar. 23, 1922, pp. 498-501, 1 fig. Rail committee presents experimental rail specification based on quiet-setting steel. Engineers and labour economics. Analysis of warehouse and freighthouse design. Specifications for moveable bridges adopted.

RAILWAY ELECTRIFICATION

ECONOMIES DUE TO. The Future of Railroading is Electrification, W. R. Steinmetz. Can. Ry. Club Official Proc., vol. 20, no. 8, 1921, pp. 16-30 (includes discussion). Discusses electrification generally in various countries, and enumerates economies due to it.

HOLLAND. Electrification of Railways in Holland (Electrificatie van de spoorwegen in Nederland), J. J. W. Van Loenen Martinet. Ingenieur, vol. 37, no. 9, Mar. 1922, pp. 151-162, 8 figs. Discusses report of commission appointed to study the question, which is review of electrification practice in various countries; also Amsterdam-Rotterdam electrification.

INDUCTION INTERFERENCE AND ELECTROLYSIS. Effects of Electric Power Used for Traction, Chas. F. Scott. Ry. Age, vol. 72, no. 11, Mar. 18, 1922, pp. 727-729, 1 fig. Inductive interference and electrolysis as related to railroad electrification.

SUPERPOWER SURVEY. Superpower Survey, Gen. Elec. Rev., vol. 25, no. 2, Feb. 1922, pp. 72-94, 15 figs. Articles on The Superpower System as an Answer to a National Power Policy by W. S. Murray; What the Superpower Survey Means to the United States, by H. Goodwin, Jr.; and Abstract of "Appendix C" of Superpower Report on the Electrification of Railroads by, W. D. Bearce.

RAILWAY MOTOR CARS

GASOLINE. Gasoline Motor Cars with Four-Wheel Drive. Ry. Age, vol. 72, no. 11, Mar. 18, 1922, 749-759, 4 figs. For passenger, freight and light switching; manufactured by Four-Wheel Drive Auto Co., Clintonville, Wis.; has three speeds; four-cylinder engine; 42 hp. by S. A. E. rules, but develops 68 hp. on a brake test.

NEW HAVEN BRANCH LINES. Motor Cars Used on New Haven Branch Lines. Ry. Mech. Engr., vol. 96, no. 3, Mar. 1922, pp. 139-141, 3 figs. Describes the Mack rail car used in local passenger service. Important advantages are flexibility and low-operating cost.

RAILWAY OPERATION

AUTOMATIC TRAIN CONTROL. The Hearing on Train Control. Ry. Rev., vol. 70, nos. 12 and 13, Mar. 25 and Apr. 1, 1922, pp. 421-424 and 455-460. Gives summary of argument of 40 American railroads represented by Am.Ry. Assn. against recent order of Interstate Commerce Commission requiring installation of automatic train control.

TONNAGE RATING. Practical Points on Dynamometer Car Tonnage Test, O. O. Carr. Ry. Rev., vol. 70, no. 13, Apr. 1, 1922, pp. 451-455. Observations on Illinois Central show inaccuracy of office ratings and false economy of reducing tonnage to increase train speed.

RAILWAY TIES

LIFE. A Means of Determining the Average Life of Ties, V. K. Hendricks. Ry. Age, vol. 72, no. 12, Mar. 25, 1922, pp. 779-783, 2 figs. Explanation of fluctuations in reqiurements on new lines and method of anticipating them.

RENEWAL COST CALCULATION. Diagram for Calculating Annual Cost of Cross Ties, E. R. Cary. Eng. & Contracting, vol. 57, no. 11, Mar. 15 1922, pp. 245-246, 2 figs. Description of making nomograph or alignment diagram.

RAILWAY TRACK

CURVES. Railway Curves: Superelevation and Maintenance, E. E. R. Tratman. Eng. News-Rec., vol. 88, nos. 11 and 12. Mar. 16 and 23, 1922, pp. 446-449 and 489-492, 2 figs. Shows variations in practice and opinion. Influence of modern locomotives relations of curvature to gage and grades; checking and marking.

RAILWAYS

ALASKA. Completing the Government Railroad in Alaska. Ry. Age. vol. 72, no. 13, April 1, 1922, pp. 813-817, 8 figs. Describes Alaska railroad opened between Seward, on Resurrection Bay, and Fairbanks, in interior, on Feb. 5, 1922, a distance of 467 miles.

REFRIGERATING MACHINES

COMPRESSION. The Compression Refrigerating Machine, Gardner T. Voorhees. Ice and Refrigeration vol. 62, no. 3, Mar. 1922, pp. 223-226, 1 fig. Study of floating heat question and clearance effect. (Continuation of serial.)

REFRIGERATION

BRINE SPRAY. Brine Spray Refrigeration S. C. Vloom. A. S.R.E. Jl., vol. 8, no. 4, Jan. 1922, pp. 308-321 (includes discussion) 10 figs. Describes experiments carried out with Webster nozzles and overhead spray systems.

RESEARCH

INDUSTRIAL. A plan for the Development of Industrial Research in Canada S. F. Ruttan. Honorary Advisory Council for Sci. and Indus. Research, Dominion of Can., Bul. no. 10. 1921, 8 pp. (Abstract.) Address before Chem. Congress, New York.

RHEOSTATS

LIQUID. Some Notes on the Design of Liquid Rheostats, W. Wilson. Inst. Elec. Engrs. Jl.,vol. 60, no. 326, Feb. 1922, pp. 196-211 and(discussion)211-217, 20 figs. Discusses the more definite determination of constants of liquid rheostat and the more exact prediction of its performance.

RIVETS

MANUFACTURE AND TYPES. Riveting (Etude sur le rivetege). Ouvrier Moderne, vol. 4, no. 11. Feb. 1922, pp. 443-447, 12 figs. Metal used; manufacture of rivets standard types of rivets; etc.

ROADS, CONCRETE

CALCIUM CHLORIDE, USE OF. The Use of Calcium Chloride in Concrete Highway Construction. B. H. Piepmeier and H. F. Clemmer. Eng. and Contracting, vol. 5, no. 14, Apr. 5, 1922, pp. 323-324, 2 figs. Points out that during past year actual practice and laboratory experiments demonstrated value of calcium chloride in highway construction to such an extent that Division of Highways of Illinois not only allowed its usage to accelerate setting of concrete in cold weather construction, but also advocates it as simple and practical method of curing. See also Highway Engr. and Contractor, vol. 6, no. 4, Apr. 1922, pp. 33-36, 5 figs.

ROADS, GRAVEL

SURFACE TREATMENT WITH TAR. Surface Treatment of Gravel Roads with Tar. Paul D. Sargent. Eng. and Contracting, vol. 57, no. 14, Apr. 5, 1922, pp. 325-327. Experiences of Maine State Highway Commission. Paper presented at Conference on Highway Engineering, at Ann Harbor, Mich.

ROLLING MILLS

DRIVES. Factors which Influence the Size of Rolling-Mill Drives, L. Rothera. Iron and Coal Trades Rev., vol. 104, no. 2818, Mar. 3, 1922, pp. 306-308, 8 figs. Choice of sections to be rolled; output required; methods of rolling; drafting of rolls; number of passes taken. From English Elec. Jl.

SHEET STEEL ROLLING. The Possilility of Improved Methods of Rolling Sheet Steel Summer B. Ely. Blast Furnace and Steel Plant, vol. 10, no. 3, Mar. 1922, pp. 175-178. Author does not think that a continuous sheet mill is impossible; believe extensive scientific experiments on the problem should be conducted. (Abstract,) Paper read before Engrs. Soc. Western, Pa.

ROPE DRIVE

CONTINUOUS AND MULTIPLE SYSTEMS. Power Transmission by Ropes. Eng. and Indus. Management, vol. 7, no. 10, Mar. 23, 1922, pp. 287-289, 3 figs. Questions of cost and efficiency construction of rope pulley drives; relative merits of continuous and multiple systems.

S

SAFETY

ORGANIZATION IN INDUSTRIAL PLANT. Safety Organization, Harry A. Schults. Safety, vol. 9, no. 3, Mar. 1922, pp. 56-74, 8 figs. Discusses in detail safety organization of an industrial plant, duties of safety committees and safety engineers, educational activities, first aid and rescue, etc.

SAND, MOLDING

HANDLING EQUIPMENT. Solving Sand Problem in a Steel Foundry, Edwin F. Cone. Iron Age. vol. 109, no. 15, Apr. 13, 1922, pp. 985-988, 6 figs. Mechanical equipment shakes out casting and prepares old and new sand with minimum of labor. Other features,

USES AND ABUSES. Uses and Abuses of Molding Sands, Eugene W. Smith. Iron Age, vol. 109, no. 13, Mar. 30, 1922, pp. 860-861. Typical American sands and their composition; sand for various metals. Discussion. Paper read before Chicago Foundrymen's Club.

SCHOOLS, TECHNICAL

OTTAWA. Wide Range of Instruction is Being Given, W. W. Nichol. Can. Machy., vol. 27, no. 11, Mar. 16, 1922, pp. 28-49, 4 figs. Activities of Ottawa Technical School, and its equipment. Subjects cover machine-shop practice, automobile mechanics, welding and cutting structural and mechanical drafting, etc.

TORONTO. This School Shows Remarkable Progress. Can. Machy., vol. 27, no. 11, Mar. 16, 1922, pp. 35-39, 8 figs. Describes the Technical High School, Toronto and its facilities and equipment.

SCIENTIFIC MANAGEMENT

See Industrial Management.

SCREW THREADS

COMPARATOR. Screw-Thread Measuring Comparators (Gewinde-Messkomparator), C. Büttner. Betrieb, vol. 4, no. 9, Feb. 11, 1922, pp. 289-292, 11 figs. Describe construction and function of a new optical screw-thread measuring machine for maximum accuracy, with which all dimensions can be determined in coefficients of measure.

SEWAGE

ODOR, ELIMINATION OF. Elimination of Odor in Sewage Gases by Burning, C. E. Leonard. Eng. News-Rec., vol. 88, no. 14, Apr. 6, 1922, pp. 565-566, 5 figs. Odors from raw sewage and treatment plant at Austin Tex., are eliminated by passing them through furnace in which fuel is the gas from digestion tanks. Plant generates its own purifying fuel.

SEWAGE DISPOSAL

CLARIFICATION AND ACTIVATION, INDIANAPOLIS. Clarification and Activation for Indianapolis Sewage,C.H. Hurd. Eng. News. Rec.,vol. 88, no. 12,Mar. 23, 1922, pp. 484-488, 5 figs. Three revolving cylindrical screens, removing 30 per cent of solids, considered sufficient for six months. Activated-sludge process added for remainder of year.

GRIT CHAMBERS. How Grit Chambers Work at the Worcester Sewage Plant, Ray S. Lamphear. Eng. News-Rec., vol. 88, no. 13, Mar. 30. 1922, pp. 519-520. Deals with velocity of flow, operation, deposition of material, quantity and character of deposit. Points out that grit may be used for dikes or roads.

SHAFTS

Torsional Vibration. Torsional Vibrations in Shafts and the Nazzaro Damper (Le vibrazioni torsionali negli alberi delle distribuzioni e lo smorzatore "Nazzaro"), Pasquale Borracci. Industria, vol. 36, no. 2, Jan. 31, 1922, pp. 26-28, 5 figs. Explains origin of torsional vibrations and describes the Nazzaro device for controlling them.

SHAFT SINKING

Freezing Process. The Latest Improvements in the Freezing Process (Das Gefrierverfahrm und seine neuesten Fortschritte), W. Landgräber. Mettall u. Erz., vol. 18, no. 19, Oct. 8, 1921, pp. 486-489. Describes methods employed in sinking a shaft through water-bearing and quisksand layers to depth of 560 m. by use of freezing process.

SHERARDIZING

Experiments. Experiments With Sherardizing Leon McCulloch. Metal Industry (N. Y.), vol. 20, no. 3, Mar. 1922, pp. 97-98. Formation of coating with special reference to amount and effect of iron in coating.

SHIP CONSTRUCTION

Reinforced-Concrete. The Present Development of Reinforced concrete Shipbuilding, W. Teubert. Shipbuilder, vol. 26, no. 139, Mar. 1922, pp. 217-220, 5 figs. Reviews development in all countries concerned with particular reference to German activities. Application of concrete by spraying process; steel coaming; etc. (Abstract) Paper communicated to Schiffbautedhnische Gesellschaft.

SHIPS, CONCRETE

Developments and Prospects. The Development of Reinforced-Concrete Ship Construction and its Prospects. (Die Entwicklung des Eisenbetonschiffbaues und seine Aussichten), Carl Commentz. Fördertechnik, u. Frachtverkerr, vol. 15, no. 5, Mar. 3, 1922, pp. 65-67, 7 figs. Review of development during war, and description of most important types. Importance of weight problem, and possibilities of reducing weight. Cost of reinforced-concrete ships.

SILVER ORE

Ontario, Canada. The Occurrence of Silver Ores in South Lorrain, Ontario, Canada, J. Mackintosh. Instn. Min. and Mettallurgy Bul., no. 209, Feb. 1922, pp. 1-17, 3 figs. General geology; vein system; character of vein material; position of ore-shoots; origin of deposits; metallurgical practice.

SMOKE ABATEMENT

Problems. The Smoke Problem, O. P. Hood. U. S. Bur. of Mines Reports of Investigation, serial no. 2323, Feb. 1922, 5 pp. Brief summary of problems. Smoke problem in England, and list of publications of Bur. of Mines dealing with problem.

SOOT BLOWERS

Steam Saving with. Steam Saving with Soot Blowers, Robert June. Textile World, vol. 41, no. 13, Apr. 1, 1922, pp. 75-76, 4 figs. Charts showing economy of improved equipment and extent of loss from excessive blowing.

SPECIFIC HEAT

Air, Steam and CO_2. The Specific Heats of Air, Steam and Carbon Dioxide, W. D. Womersley. Roy. Soc. Proc., vol. 100, no. A 706, Feb. 1. 1922, pp. 483-498, 10 figs. Describes experiments with improved Hopkinson calorimeter and gives results of hydrogen-air and carbon-monoxide experiments.

STACKS

Venturi. Venturi Stacks, A. W. H. Griepe. Combustion, vol. 6, no. 4, Apr. 1922, pp. 166-175, 18 figs. Describes Venturi-Evase-Prat-Stacks and their functioning, advantages and disadvantages, and compares different systems.

STANDARDIZATION

Norway. Standardization in Norway (Standardiseringssporsmaalet i Norge). Teknisk Ukeblad, vol. 69, no. 8, Feb. 24, 1922, pp. 69-73. Report of committee to Norwegian Society of Industrials giving review of standardization work in countries abroad.

Progress. Progress in Engineering Standardization, C. W. Ham. Am. Mach., vol. 56, no. 13, Mar. 30, 1922, pp. 465-466. Advantage of simplified designs and adoption of uniform methods. Shop operation simplified, number of jigs reduced stocking of parts in large quantities becomes possible. Work of American Engineering Standards Committee in establishing national and international standards.

Society Automotive Engrs. Work of. S. A. E's Recent Standardization Work. Automotive Industries. vol. 46, no. 14, Apr. 6, 1922, pp. 768-770, 2 figs. Revision in ball-bearing standards; Bessemer steel and wire spring stock; distributor, magneto and bumper mounting; motor-boat controls; passenger-car frames.

STEAM ENGINES

Back Pressure, Reducing. Using Exhaust Velocity To Reduce Back Pressure in Steam Engine. Power, vol. 55, no. 14. Apr, 4, 1922, p. 542, 3 figs. Prof. Stumpf and his associates in designing a unaflow locomotive, have been able, by modification of exhaust ports and piping to reduce back pressure on cylinder.

STEAM GENERATORS

Efficient. Modern Steam Generators for the Efficient Utilization of Gaseous Fuels and the Efficient Recovery of Waste Heat, P. St. G. Kirke. West of Scotland Iron and Steel Inst. Jl. vol. 29, Part 3, Dec., Session 1921-1922, pp. 28-34 and (discussion) 34-36, 9 figs. on supp. plates. Discusses boiler development, including the Hopwood Spencer Hopwood, Bonecourt, Kirke and other types.

STEAM POWER PLANTS

Fuel Conservation. Fuel Conservation in Industrial Power Plants, David Moffat Myers. Gen. Elec. Rev., vol. 25, no. 2, Feb. 1922, pp. 95-98. Effecting economies in steam plants by proper equipment of recording instruments selected to suit local conditions.

Heat Balance and Steam Distribution. Heat Balance and Steam Distribution in a Large Service Plant, S. D. Kutner. Power, vol. 55, no. 13, Mar. 28, 1922, pp. 488-491, 1 fig. Tells how steam, hot water and power are charged to different departments in large building supplied from an isolated power plant.

STEAM TURBINES

Modern Installation. A Modern Steam-Turbine Installation in Spitzbergen), Eine moderne Dampfturbinen-Anlage auf Spitzbergen), A. C. Gogstad. Schweizerische Bauzeitung, vol. 79, no. 12, Mar. 25, 1922, pp. 149-151, 4 figs. Describes central station and equipment delivered by Oerlikon Machine Works, Switzerland.

STEEL

Alloy. *See Alloy Steels.*

Stainless, Cutlery of. Making Steel Cutlery R.G. Hall. Iron Trade Rev., vol. 70, no. 13, Mar. 30, 1922, pp. 896-897. Carbon content of 0.30 to 0.45 per cent and chromium 13 to 15 per cent is recommended. Roll scale must be eliminated and working tools kept sharp to prevent cause for oxidation. Stainless tests. See also (abstract) in Iron Age, vol. 109, no. 13, Mar, 30, 1922, pp. 855-856.

STEEL, HEAT TREATMENT OF

Structural Parts. Heat Treating Steel For Structural Parts, Horace C. Knerr. Blast Furnace and Steel Plant, vol. 10, no. 3, Mar. 1922, pp. 178-183, 10 figs. Means of estimating carbon from microstructure after annealing; comparison of effects of heat treatment on various steels from mild to tool steel.

Principles. Theory of the Heat Treatment of Steel, Walter M. Mitchell. Forging and Heat Treating, vol. 8, nos. 1, 2 and 3, Jan., Feb. and Mar. 1922, pp. 52-56, 114-118 and 162-166, 20 figs. Jan.: Critical temperatures; constitution of slowly cooling steel. Feb.: Constituents of suddenly cooled steels; practice in heat treatment. Mar.: Discusses hardening and tempering and deduces schedule of heat treatment.

STEEL MANUFACTURE

Basset Process. Steel Direct from Ore by Basset Process, Fritz Wuest. Iron Age, vol. 109, no. 15, Apr. 13, 1922, pp. 989-991, 2 figs. Its chief features and advantatages. Critical discussion of claims for French process by German engineer. Cost of plant. Translated from Stahl u. Eisen Dec. 22, 1921.

High-Speed and Tungsten. Notes on the Manufacture of High-Speed and Tungsten Steels, J. W. Weitzenkorn. Chem. and Met. Eng., vol. 26, no. 11, Mar. 15, 1922, pp. 504-508, 14 figs. Steps taken in studying segregation in high-speed and tungsten steel. Structural disposition of carbides after various heat treatments, with or without previous mechanical work.

Losses, Reducing. Reducing Losses in Steelmaking, F. G. Cutler. Iron Trade Rev., vol. 70, no. 15, Apr. 13, 1922, pp. 1040-1042, 2 figs. Method of comparing total combustion efficiency of iron and steel plant from time to time is proposed. Economic use of blast-furnace and coke-oven gas. (Abstract.) Paper to be presented before Am. Soc. Mech. Engrs.

STEEL WORKS

Calcutta, India. New Plant of the Indian Iron and Steel Company, Limited. Iron and Coal Trades Rev., vol. 104, no. 2815, Feb. 10, 1922, p. 198, 3 figs. Describes design and equipment.

Electric Power in. The Application of Electric Power in the Iron and Steel Industry, W. S. Hall. Iron and Steel Elec. Engrs. Assn., vol. 4, no. 3, Mar. 1922, pp. 127-140 and (discussion) pp. 140-151. Brief analysis of sources of waste fuel in iron and steel manufacture; determining whether expenditure for recovering waste fuel is desirable. Problems of power generation and transmission.

Power-Plant Management. Steel Works Power Plant Management, Robert June. Blast Furnace and Steel Plant, vol. 10, no. 3, Mar. 1922, pp. 197-201, 3 figs. Fixed charges and maintenance; manner of figuring depreciation of powerhouse equipment.

STOKERS

Underfeed. A New Type of Underfeed Stoker. Steam, vol. 29, no. 3, Mar. 1922, pp. 75-77, 7 figs. Describes stoker built by Detroit Stoker Co., Detroit, Mich., made in two designs, one a single retort, side cleaning stoker for boilers up to three or four hundred horsepower, and the other a multiple retort end cleaning type for large installations.

STORAGE BATTERIES

Lead-Hydrate. The Lead Hydrate Storage Battery. Elec. Rev. (Lond.).vol. 90, no. 2313, Mar, 24, 1922, pp. 402-404, 8 figs. Describes lead-hydrate battery made by Siebe, Gorman & Co., Ltd., Lond., which, it is claimed, has 300 to 800 per cent greater capacity than any other battery has hitherto attained.

STREET RAILWAYS

Cars, Safety. Recent Developments in Car Design, H. H. Adams. Elec. Ry. Jl., vol. 59, no. 12, Mar. 25, 1922, pp. 520-522, 7 figs. Describes automatic treadle-operated exit door of new double door Chicago safety car. (Abstract). Paper read before Ill. Elec. Rys. Assn.

Shallow-Conduit Construction. Installing Shallow-Conduit Construction in Washington, D. E. Dunn. Elec. Ry. Jl., vol. 59, no. 11, Mar. 18, 1922, pp. 449-452, 14 figs. Describes replacing old type of deep tube cable construction with new shallow tubes by Traction Co.

Toronto. Toronto Takes Over Street Railways. Elec. Ry. Jl. vol. 59, no. 12, Mar 25, 1922, pp. 505-511, 12 figs. Principal features of franchise; statistics of Toronto traffic; municipal operating organization; financial arrangement; etc

Manufacturing Machinery, Hawaii. Progress in Hawaii in the Design of Sugar Manufacturing Machinery. Int. Sugar Jl., vol. 24, no. 278, Feb. 1922, pp. 81-85, 7 figs. Summary of report of Committee on Manufacturing Machinery, appointed by Hawaiian Sugar Planters' Assn. [illegible] Heaters Kopke clarifier; Daniel's centrifugal discharge, revolving cane cutting knives.

SUPERPOWER PLANT

Advantages and Prospects. The Superpower System, Henry Flood, Jr. Steam, vol. 29, no. 2, Feb. 1922, pp. 37-40. Summarizes advantages of superpower and immediate outlook for its realization.

SURVEYING

Photographic. Developments in Photographic Surveying, M. P. Bridgland. Can. Engr., vol. 42, no. 14, Apr. 4, 1922, pp. 359-363, 7 figs. States that camera can be used to best advantages in high mountain ranges. Describes apparatus used. How photographs are taken and plotted. More work in office than in field.

T

TELEPHONY

Automatic. Automatic Telephone System of the Siemens & Halske Corp. (Selbsttätige Fernsprechvermietelung für Privatbetriebe), G. Quaink. Dinglers polytechnischer Jl., vol. 337, no. 4, Feb. 25, 1922, pp. 31-33, 5 figs. Details of system, advantages of which are quick service in connecting and disconnecting, elimination of operators, and privacy of conversation.

TESTING MACHINES

Bearings. Testing Machine to Show Relative Merits of Bearings, R. W. Sellow. Belting, vol. 20, no. 3, Mar. 1922, pp. 51-53, 4 figs. Describes machine which shows relative difference in power consumption of various types of bearings; by its method of driving bearing shafts and of applying load to bearings it is adaptable to any reasonable conditions of test.

Hardness. A New Impact Hardness Testing Machine. (Schlaghärteprüfer nach Prof. Rich. Baumann, Stuttgart). Allgemeine Automobil-Zeitung, vol. 22, no. 43, Oct. 22, 1921, pp. 31-32, 5 figs. Describes new apparatus designed by Richard Baumann, head of material-testing bureau of Technical Academy, Stuttgart. Its cost is said to be about one-fifth that of Brinell testing machine, it is light in weight and easily handled.

THERMOCOUPLES

Platinum : Platinum-Rhodium. Life Tests of Platinum: Platinum-Rhodium Thermocouples, C. O. Fairchild and H. M. Schmidtt. Metal Industry (Lond.), vol. 20, no. 11, Mar. 17, 1922, pp. 245-246. Discusses deterioration at high temperatures, requiring frequent replacement or recalibration. Published by permission of Bur. of Standards.

TOOLS

Manufacture of Machinists. Machinists' Tools and Their Manufacture. Engineering, vol. 113, no. 2932, Mar. 10, 1922, pp. 290-292, 7 figs. Particulars of tools and manufacturing methods adopted for their production in works of C. A. Vandervell & Co., Ltd., London. Deals with production of calipers and dividers, vee blocks and clamps, scribing bolcks, etc.

TRACTORS

Chain-Track. The New Transport. Motor Transport, vol. 34, no. 890, Mar. 29, 1922, pp. 341-345, 12 figs. Describes chain-track tractors which embodies principles introduced into 25-mile-an-hour tanks that appeared after war.

Standards in Manufacture. The Value of Standards in Tractor Manufacture, P. M. Heldt. Soc. Automotive Engrs. Jl., vol. 10, no. 4, Apr. 1922, pp. 270-272. Outlines history of systematic introduction of standards in mechanical manufacture. Discusses steel and other standards, such as tractor hitches, belt speeds, connections between parts or machines made in different plants, screw sizes, lug attachment, etc.

Two-Wheeled, Stability of. Stability of Two-Wheeled Tractors, P. M. Heldt. Automotive Industries, vol. 46, no. 11, Mar. 10, 1922, pp. 614-616, 4 figs. Principles and calculation of torque, pressure, drawbar-pull, etc.

TRANSFORMERS

1,000,000-Volt Testing. A Million Volt Testing Transformer, J. F. Peters. Elec. Jl., vol. 19, no. 3, Mar. 1922, pp. 97-99, 5 figs. Details of construction.

Operation on Temperature Basis. Operating Distribution Transformers on a Temperature Basis, L. L. Elden. Elec. World, vol. 79, no. 13, Apr. 1, 1922, pp. 623-630, 7 figs. Diversity factor is said to be unreliable index of service requirements. Use of indicating equipment enables operation at higher temperature to be safely continued with marked economic advantages. Includes list of 21 observations and conclusions regarding transformer operation on temperature basis.

TRANSPORTATION

Highway. Highway Transportation. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 3, Mar. 1922, pp. 506-522. Symposium containing following articles: Highway Inspection, H. E. Hilts. Financing and Bonding, Frederick S. Greene and Herbert S. Sisson. Discussion.

TUBES

Billet-Piercing Machine for Making. An Improved Billet Piercing Machine for Solid Drawn Tube Making. Metal Industry (Lond.), vol. 20 no.11, Mar. 17, 1922, p. 255, 1 fig. Describes machine made by Fisher, Humphries & Co., for piercing copper billets as well as steel billets.

Seamless. The Manufacture of Seamless Tubing, Philip Davidson. Raw Material, vol. 5, no. 2, Mar. 1922, pp. 46-52, 27 figs. Describes operations at Scoville Mfg. Co.'s works, Waterbury, Conn.

TUBING

Seamless Steel. Experiments With Weldless Steel Tubing As Used in Construction W. W. Hackett. Practical Engr., vol. 65, nos. 1820 and 1821, Jan. 12 and 19, 1922, pp. 21-22 and 43-44, 4 figs. Short review of seamless tubes; describes tests made on front forks, plain tubes held in a loose socket, and on tubes brazed 1 in. into thick lugs results of alternating stress tests, showing effects of cut, with sharp corners, in high and medium-carbon steels. (Abstract.) Paper read before Instn. Automobile Engrs.

TUNGSTEN

Manufacture of Metallic. The Manufacture of Metallic Tungsten. Chem. Trade Jl. & Chem. Engr., vol. 70, no. 1813, Feb. 17, 1922, pp. 190-200. Production of red tungstate; crystallization of sodium tungstate; washing tungstic acid; purification of tungstic acid; reduction; etc.

Working of. The Working of Tungsten. So. African Instn. Engrs. Jl., vol. 20, no. 7, Feb. 1922, pp. 121-129, (includes discussion). Describes installation in England of factory for making tungsten metal, based on American practice, and how the various problems were solved.

TUNNELLING

Hard-Rock. Modern Practice in Driving Western Hard-Rock Tunnels, R. C. Starr. Eng. News-Rec., vol. 88, no. 15, Apr. 13, 1922, pp. 598-601, 5 figs. Discusses factors affecting size, progress and cost in large power tunnels; depth and relation of drill holes, heading and mucking methods.

TUNNELS

Vehicular. Specification Details of Hudson River Vehicle Tunnel. Eng. News-Rec., vol. 88, no. 14, Apr. 6, 1922, pp. 574-575, 2 figs. Largest subaqueous tunnels in United States to be built by compressed-air shield method. Some contract provisions.

V

VACUUM TUBES

Thermionic Valves. The Manufacture of the Mullard Valve. Electrician, vol. 88, no. 2287, Mar. 17, 1922, pp. 317-319, 5 figs. Made by Mullard Radio Valve Co., Ltd. Notes on the grid, filament construction and mounting, testing arrangements, advantages of silica. etc.

VALVES

Automatic Control. Automatic Control Valve for Hydraulic Presses. Engineer, vol. 133, no. 3455, Mar. 17, 1922, p. 308, 10 figs. Describes Barton- Carr patented control valve which is entirely automatic in its action from first operation onward until point of maximum high pressure is reached.

Manganese Bronze for Stems. Manganese Bronze for Valve Stems, William R. Conrad. N. E. Water Works Assn. Jl., vol. 36, no. 1, Mar. 1922, pp. 32-36 and (discussion) pp. 37-39. Deals with valves as used for water-works purposes.

VENTILATION

Electric. Electric Ventilating, Wm. T. Reace and Geo. C. Breidert. Elec. Jl., vol. 19, no. 3, Mar. 1922, pp. 119-123, 8 figs. Use in the home, retail stores, industrial plants, restaurants, and for farmers. Right and wrong way to install ventilating fans. Unit heaters.

Temperature, Humidity and Air-Motion Effects. Temperature, Humidity and Air Motion Effects in Ventilation, O. W. Armspach and Margaret Ingels. Am. Soc. Heating & Vent. Engrs. Jl., vol. 28, no. 2, Mar. 1922, pp. 173-190, 17 figs. Consideration of fundamental laws underlying loss of heat from human body and resulting feelings of comfort or discomfort in air under various conditions of temperature. humidity and rate of air movement.

VOCATIONAL TRAINING

Blind. Blind Efficiently Operate Machine Tools., Hubert Hermanns. Iron Age, vol. 109, no. 11, Mar. 16, 1922, p. 733, 5 figs. Siemens-Schuckert Works in Berlin conduct series of experiments to determine proper training methods.

W

WASTE ELIMINATION

Economic Fundamentals. Elimination of Waste and Improvement of Efficiency. What are the Economic Fundamentals? W. R. Ingalls. Min. & Metallurgy, no. 183, Mar. 1922, pp. 33-37. Writer points out that miscalculations in industry will decrease along with increase in transparency in industry, meaning acquisition of knowledge about it and thereby ability to see through it and ahead.

Factories. Searching Out the Invisible Wastes, C. J. Morrison. Indus. Management, vol. 63, no. 4, Apr. 1922, pp. 196-197. Calls attention to persistent and prevalent sources of loss found in every factory, which can generally be eliminated.

WATER GAS

Production, Continuous Process. Continuous Oil-Water-Gas Process, Joseph D. Baucus. Gas Age-Rec., vol. 49, no. 9, Mar. 4, 1922, pp. 267-269. Describes the Van Steenbergh continuous process for production of water gas, and report made as to its operation and cost.

WATER POWER

Mechanical Storage. The Mechanical Storage of Water Power. Elec. Rev. (Lond.), vol. 90, no. 3211. Mar. 10, 1922, pp. 327-330, 9 figs. Describes Walkeburn hydroelectric scheme. Low-pressure turbines consist of two large double-runner, horizontal Francis turbines, 110 hp. each, running at speed of 200 r.p.m., the Pelton wheel runs at 1,000 r.p.m. and is coupled direct to 155-kw. generator; arrangement of generator pumps and gearing.

Mechanical Storage of Water Power as a Factor in Textile Production. Electrician, vol. 88, no. 2284, Feb. 24, 1922, pp. 229-233, 6 figs. Describes hydro-electric installation at Henry Ballantyne & Sons' Tweedvale and Tweedholm mills, special feature of which is method adopted for water storage during non-working hours.

RESOURCES, CANADA. Water Power Resources of Canada, J. T. Johnston. Can. Engr., vol. 42, no. 13, Mar. 28, 1922, pp. 343-346. Review of hydroelectric development; power utilized in central station and pulp and paper industries. Many water powers not yet developed.

UNITED STATES. Developed and Potential Water Powers of the United States. Elec. World, vol. 79, no. 11, Mar. 18, 1922, pp. 531-532, 1 fig. Government compilation indicates that capacity of water-wheels installed in plants of 100 hp. or more is 7,852, 948 hp. Almost 80 per cent in public-utility generating plants.

WATER PURIFICATION

METHODS. Purification of Water Supplies, James O. Meadows. Contract Rec., vol. 36, no. 13, Mar. 29, 1922, pp. 285-287. Refinements in composition of filtration equipment. Value of chlorine disinfection. Purifying water for industrial. Paper before Montreal Section of Soc. Chem. Research.

WATER SUPPLY

STORAGE PROJECTS, NEW JERSEY. Huge Water Storage Projects for New Jersey District. Eng. News-Rec., vol. 88, no. 11, Mar. 16, 1922, pp. 430-435, 5 figs. Details of four plans by Allen Hazen, any one of which would give supply for several decades. Combinations of reservoirs and Delaware River flow would yield three times 1970 needs.

WELDING

BOILER. Boiler Welding, Edward H. Heidel. Acetylene Jl., vol. 23, no. 9, Mar. 1922, pp. 431-435 and 470, 15 figs. Gives restrictions placed on loconotives boiler welding known as A.R.A. restrictions. Directions for autogenous, electric and gas welding of boiler parts.

HYDE PROCESS. Hyde Welding Process, D. Richardson. Welding Engr., vol. 7, no. 3, Mar. 1922, pp. 32-34. Describes method of uniting iron and steel which partakes of nature of both welding and brazing, consisting of uniting surfaces by means of molten copper, the copper impregnating mass of metal to be joined.

[*See also Boilers, Welding; Cast Iron, Welding; Electric Welding; Electric Welding, Arc; Locomotive Boilers, Welding; Oxy-Acetylene Welding; Railway Shops, Welding Practice*]

WIND PRESSURE

HIGH ELEVATIONS, AT. Wind Pressures at High Elevations and Their Application to Radio Towers, R. Fleming. Eng. News-Rec., vol. 88, no. 11, Mar. 16, 1922, pp. 438-442. Review of practice and theory. Observations showing that wind velocity increases with height. Recommended leads and stresses for design of high towers.

WIND TUNNELS

MASSACHUSETTS INSTITUTE OF TECHNOLOGY. The Aerodynamical Laboratory of the M.I.T., Edward P. Warner. Aviation, vol. 12, no. 11, Mar. 13, 1922, pp. 308-310, 3 figs. Recent additions of two new wind tunnels greatly increase operating capcity of America's oldest research establishment. Constructional details.

WOOD PRESERVATION

THEORY. Theory on the Mechanism of Protection of Wood by Preservatives, Ernest Bateman. Wisconsin Engr., vol. 26, no. 5, Feb. 1922, pp. 79-94 and 98, 5 figs. Experimental work of obtaining a non-toxic or "barren" oil from coal-tar creosote; a mathematical treatment to point out existence of a solubility partition. Presented before Am. Wood-Preservers' Assn. (Concluded.)

Z

ZINC

ELECTROLYTIC. Effects of Impurities on Electrolytic Zinc, Guilfore Darby Scholl. Chem. & Met. Eng., vol. 26, no. 13, Mar. 29, 1922, pp. 595-602, 39 figs. Photographs of cathodes made in commercial cells after addition to electrolyte of one or two parts per million of arsenic, antimony, cobalt, copper, nickel and glue; severe action commences several hours after addition.

RESEARCH. Research Work on Zinc and Zinc Allors, Wallace Dent Williams. Can. Foundryman, vol. 13, no. 3, Mar. 1922, pp. 26-27 and 30, 8 figs. Discusses alloys with high percentage of zinc replacing brass with favourable results.

ZINC METALLURGY

BLUE POWDER IN SMELTING. Blue Powder in Zinc Smelting, W. R. Ingalls. Min. and Metallurgy, no. 184, Apr. 1922, pp. 13'14. It is shown that blue powder product bears large proportion to ore originally charged into retorts; that large proportion of retort capacity is devoted to redistillation of blue powder; and that of spelter product of furnace about 30 per cent is derived from blue powder.

ZINC ORE

HYDRO-METALLURGY OF LOW-GRADE. Hydro-Metallurgy of Low-Grade Zinc Ores, Motohiro Namba. Min. and Sci. Press, vol. 124, no. 9, Mar. 4, 1922, pp. 301-306. Abstracted from Jl. Soc. Chem. Ind., vol. 40, no. 23.

3

Engineering Index

This Index is prepared by the American Society of Mechanical Engineers.

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A

ACETYLENE

HIGH-PRESSURE APPARATUS. High-Pressure Acetylene Apparatus (Hochdruck-Acetylenapparate), K. Matzinger. Autogene Metallbearbeitung, vol. 15, no. 6, Mar. 15, 1922, pp. 80-82, 4 figs. Describes apparatus used for Schoop's metal-spraying process built by Continental Light & Apparatus Construction Co., in Zurich-Dūbendorf.

AERIAL PHOTOGRAPHY

CAMERAS. Practical Uses of Aerial Photography. Aviation, vol. 12, no. 15, Apr. 10, 1922, pp. 424-426, 5 figs. Describes Fairchild camera used for producting aerial map of New York City

AIRCRAFT

RESEARCH. The Progress of Research, R. K. Bagnall-Wild. Aerial Age, vol. 15, nos. 4 and 5, Apr. 3 and 10, 1922, pp. 78-79 and 103-104. Aero engine research; navigation; machines; materials. See also Flight, vol. 14, no. 8, Feb. 23, 1922, pp. 122-124.

AIR COMPRESSORS

NEW EFFICIENT TYPE. A New Air Compressor. Oil Eng. & Finance, vol. 1, no. 2, Mar. 25, 1922, pp. 378-380, 2 figs. Designed by A. H. Sproule which overcomes some of previous losses

ROTARY. The Planche Rotary Compressor (Compresseur rotatif, système R. Planche) Lucien Fournier, Génie Civil, vol. 80, no. 12, Mar. 25, 1922, pp. 275-277, 10 figs. Describes rotary air compressor based on principle of conchoidal motion of a disk-piston, and gives results of tests

AIRPLANE ENGINES

LIGHT-WEIGHT. Special Light-Weight Aero Engine, A. E. L. Chorlton. Aeronautical Jl., vol. 26, no. 136, Apr. 1922, pp. 137-148, 1 fig. Discusses the more important types of engines and gives principal characteristics in tables.
STARTING AT LOW TEMPERATURE. Starting Aircraft Engines at Low Temperatures. Aviation, vol. 12, no. 18, May 1, 1922, p. 505. Abstract from technical memorandum no. 29, Canadian Air Board, by Prof. Robb at Edmonton, Alberta.

AIRPLANES

AIR-SPEED RECORDER. Manometer For Recording Air Speed, C. Wieselberger. Aerial Age, vol. 15, no. 6, Apr. 17, 1922, pp. 131-132, 3 figs. Describes instrument made at Gottingen aerodynamic laboratory, answering following conditions: (1) Must respond quickly so that all speed variations will be correctly recorded. (2) Must not be affected by rectilinear or curvilinear accelerations. Hence, movable parts must be counterbalanced. Translated from Zeit, für Flugtechnik u. Motorluftschiffahrt.
HANDLEY PAGE W. 8B. The Handley Page W. 8b. Aeroplane, vol. 22, no. 16, Apr. 19, 1922, pp. 280-281, 12 figs. Description of design to be used on Handley Page service, modification of well-known W.S.
SUSPENDED WING FOR TEST. Aeroplane Will Carry Suspended Wing in Teet. Aerial Age Weekly, vol. 15, no. 7, Apr. 14, 1922, p. 151. Full size wing to be tested for first time at Langley Field Laboratory of Nat. Advisory Com. for Aeronautics. Inverted and supported from plane by three wires.
THEORY OF STABILITY. A Theory and its Proof, G. A. Spratt. Aviation, vol. 12, no. 18, May 1, 1922, pp. 510-511, 2 figs. Some theoretical consideration in the design of gliding and soaring aircraft, especially low-power sport airplanes.

AIRSHIPS

SURFACE AREA. Determination of Surface Area for Airships, Edward P. Warner. Aviation, vol. 12, no. 16, Apr. 17, 1922, pp. 450-451, 1 fig. Discusses use of Lieutenant Diehl's formula.
TESTING MODELS. Hydrostatic Test of an Airship Model. Aerial Age Weekly, vol. 15, no. 7, Apr. 24, 1922, pp. 154-155, 158, 166, 4 figs. Goodyear Rubber Co. model studies with both ballonets empty, forward ballonet filled with air, rear ballonet filled with air, and both ballonets filled with air.

ALLOYS

ALUMINUM. *See aluminum alloys.*
CALITE. Calite—A New Heat Resisting Alloy. Automotive Industries, vol. 46, no. 18, May 4, 1922, p. 955. New Heat-resisting alloy containing aluminum, nickel and iron which resists oxidization up to 2,200 deg. Fahr.
COBALT-TUNGSTEN. Cobalt-Tungsten Alloys (Kobalt-Wolframlegierungen), Karl Kreitz. Metall u. Erz. vol. 19, no. 6, Mar. 22, 1922, pp. 137-140, 1 fig. A diagram of state for cobalt-tungsten alloys is plotted and conditions for obtaining a faultless casting are determined.
ELECTROCHEMISTRY. The Electrochemistry of Metal Alloys (Die Elektrochemie der Metallegierungen) R. Kremann. Metall, no. 5, Mar. 10, 1922, pp.. 53-55. Effect of precipitation on behavior and composition of alloys.
NICKEL. *See nickel alloys.*
ZINC. *See zinc alloys.*

ALUMINUM

CERIUM, INFLUENCE OF. Influence of Cerium on Aluminum and Other Light Metal Alloys, Josef Schulte. Metal Industry (N.Y.), vol. 20, no. 4, Apr. 1922, pp. 142-144, 1 fig. Describes experiments carried out with view to improving, melting and soldering of light metals. Translated from Metall und Erz, May 22, 1921.
PLATE, DECOMPOSITION. Decomposition of Aluminum Plate (Zersetzungserscheinungen an Aluminiumblechen), H. Kropf. Metall-Technik, vol. 48, nos. 8-9, Feb. 25, 1922, pp. 68-69. Gives results of investigations carried out by Prof. Heyn and Bauer on three different kinds of aluminum plate showing signs of decomposition.

ALUMINUM ALLOYS

ALUMINUM-SILICON. Aluminum-Silicon Alloys, Zay Jeffries. Chem. & Met. Eng., vol. 26, no. 16, Apr. 19, 1922, pp. 750-754, 15 figs. Coming into use because of superior casting qualities; history, technical properties, and characteristics.
BRONZES. Aluminum Bronze, An Alloy of Strength, Wallam Dint Williams. Raw material, vol. 5, No. 3, Apr. 1922, pp. 105-109, 15 figs. Discusses an alloy, of 90 per cent Cu and 10 per cent Al, its properties, macrographic examination, casting, etc. Taken from Revue de Métallurgie.
FAILURE, CASES OF. Some Cases of Failure in "Aluminum" Alloys, W. Rosenthain Metal Industry (N.Y.) vol. 20, No. 4, Apr. 1922, p. 140, 2 figs. Shows that many of aluminum alloys which fail are not really aluminum alloys. Read before British Inst. Metals.
HIGH STRENGTH OF. New Aluminum Alloys of High Strength. Chem. & Met. Eng., vol. 26, no. 15, Apr. 12, 1922, pp. 689-694, 5 figs. Digest of eleventh report of Alloys Research Committee of British Instn. Mech. Engrs. Properties of some alloys; permanence and constitution of alloys; age-hardening with magnesium and silicon.
SILICON, WITH. Alloys of Aluminum with Silicon, H. Sutton. Metal Industry (Lond.), vol. 20, no. 16, Apr. 21, 1922, pp. 365-366, 2 figs. Some investigations of ternary and more complex alloys.
"Y ALLOY." Y Alloy (Aluminum-Copper-Nickel-Magnesium), Chem. & Met. Eng., vol. 26, no. 17, Apr. 26, 1922, pp. 785-787, 6 figs. A light aluminum alloy having strength of soft steel and good ductility; easy to cast and roll; retains its desirable properties in gas-engine parts working at 250 deg. Cent.; immune from season cracking and corrosion.

AMMONIA

BY-PRODUCT AND SYNTHETIC. By-Product and Synthetic Ammonia, Gas. Engr. vol. 38, no. 549, Jan. 16, 1922, pp. 8-10. Value of ammonia for soil fertilization and relative merits of two systems of obtaining it.

REFRIGERATING CAPACITY OF. A Pound of Ammonia, John E. Starr. Refrig. World, vol. 57, no. 4, Apr. 1922, pp. 11-12. Method by which amount of refrigeration can be computed directly from weight of ammonia boiled per hour.

AMMONIA COMPRESSORS

Dry and Wet Methods. Operating Ammonia Compressors, W. S. Doan. Refrig. World, vol. 57, no. 4, Apr. 1922, pp. 17-18, 3 figs. Relative merits of two methods of compression.

ANILINE

Catalytic Preparation. Catalytic Preparation of Aniline, O. W. Brown and C. O. Henke. Jl. Physical Chem., vol. 26, no. 3, Mar. 1922, pp. 272-287, 4 figs. Results of studies on effect of different catalysts on reduction of nitrobenzene to aniline by hydrogen in presence on nickel, and copper catalysts.

ANTIMONY

Uses. Modern Uses of Antimony (Les usages modernes de l'antimoine), Albert Hutin. Nature, no. 2502, Mar. 18, 1922, pp. 172-174. Briefly describes deposits in various countries, and metallurgy, including alloys.

APPRENTICES, TRAINING OF

New Plan. A Constructive Apprenticeship Movement. Sheet Metal Worker, vol. 13, no. 5, Mar. 31, 1922, pp. 153 and 161. Discusses new plan approved by employer, in operation in New York, and recommended by New York Building Congress.

ASBESTOS

Utilization of Waste. The Utilization of Asbestos Waste. India-Rubber Jl., vol. 63, no. 15, Apr. 15, 1922, pp. 15-16, 1 fig. Difference of asbestos from other organic fiber makes this special problem. Suggestions of various uses for same.

ASPHALT

Concrete Mixes, Control of. Control of Asphaltic Concrete Mixes, Ellis R. Dutton. Mun. and County Eng. vol. 62, no. 4, Apr. 1922, pp. 121-122, 2 figs. Method of selecting proper proportions of various ingredients.

Trinidad's Pitch Lake. Trinidad's Famous Pitch Lake, Col. H. A. Judd. Petroleum Times, vol. 7, no. 171, Apr. 15, 1922, pp. 501-502, 4 figs. Description giving some idea of its value as a source of supply.

ATOMS

Artificial. Artificial Disintegration of the Elements, Ernest Rutherford. Chem. Soc. Jl., vol. 121-122, no. 713, Mar, 1922, pp. 400-415, 4 figs. Concludes that atoms are such stable structures and nuclei are held together by such powerful forces that only most concentrated source of energy like the a-particle is likely to be effective in an attack.

AUTOGENOUS WELDING

Preheating. Preheating in Autogenous Welding (Uber das Vorwarmen bei der autogenen Schweissung), Theo Kautny. Autogene Metallbearbeitung, vol. 15, no. 3, Feb. 1, 1922, pp. 35-39, 8 figs. Advantages of preheating; describes Acme preheater, built by Lausanne Machine Co.

AUTOMOBILE ENGINES

Heavy-Oil. A Heavy-Oil Automobile Engine (Un moteur d'automobile à huile lourde). Nature, no. 2499, Feb. 25, 1922, pp. 115-120, 4 figs. Describes the Peugeot engine which operates on kerosene, mazout or vegetable oils and has smaller fuel consumption in addition.

Oil-Cooled. British Oil-Cooled Car Engines, M. W. Bourdon. Automotive Industries, vol. 46, no. 16, Apr. 20, 1922, pp. 849-851, 2 figs. Description of oil-cooled engines developed by G. M. Bradshaw, English airplane engine expert. Claimed to have all advantages of air-cooled engine and none of drawbacks.

Stutz. New Stutz Engine More Powerful; Higher Maximum Car Speed. Motor Age, vol. 41, no. 15, Apr. 13, 1922, pp. 16-17, 5 figs. Better handling of fuel, lighter and shorter pistons, better water circulation.

AUTOMOBILE FUELS

Alcohol and Gasoline Mixtures. Using Mixtures of Alcohol and Gasoline in Engines (Note sur l'utilisation, dans les moteurs des mélanges d'alcool et d'essence), Nicolardot. Technique Automobile et Aérienne, vol. 12, no. 115, 1921 and vol. 13, no. 116, 1922, pp. 116-124 and 18-21, 9 figs. No. 115: Discusses solubility of alcohol in gasoline and experiments made for French war office. No. 116: Fives curve diagrams for solubility limits of alcohol, gasoline, benzol, and explains their application.

Detonation. Detonation—A Consideration of Its Causes, Stanwood W. Sparrow. Automotive Industries, vol. 46, no. 18, May 4, 1922, pp. 951-955, 5 figs. Consideration of tendency of fuel to detonate. Effect of explosion pressure, spark advance and other related factors.

Naphtalene. Hydrated Naphthalene as Automobile Fuel (Hydriertes Naphthalin als Betriebstoff fur Automobile), J. Formánek. Allgemeine Automobil-Zeitung, vol. 23, no. 10, Mar. 11, 1922, pp. 27-29. Describes experiments made which show that tetraline and decaline mixed with benzol and benzene can be used to advantage; tetraline, is superior to benzene or benzol.

AUTOMOBILES

Automatic Chassis Lubrication. An Automatic Chassis Lubricating System. Automotive Industries, vol. 46, no. 18, May 4, 1922, pp. 950, 1 fig. New Chalco [illegible], with oil and grease cups on chassis.

Differential-Compensating. A New Type of Compensating Differential. Automotive Industries, vol. 46, no. 16, Apr. 20, 1922, pp. 857-858, 3 figs. Description of Krohn differential, which allows maximum differential action [illegible] resistance at greater r.p.m.

[illegible] Rear Wheel. Rear Wheel Dynamometer Tests and Their Significance to the Engineer, Herbert Chase. Automotive Industries, vol. 46, no. 16, Apr. 20, 1922, pp. 859-868, 27 figs. Description and data from apparatus in Mason Laboratory, Sheffield Sci. School, Yale Univ. Includes comments on rolling friction, wind resistance, tractive effort, and fuel economy.

Gear Ratio 1914-1922. Rear Axle Gear Ratios of Passenger Cars from 1914 to 1922. Motor Age, vol. 41, no. 18, May 4, 1922, pp. 48-51, 1 fig. Tables of gear ratios [illegible]

M[illegible] Standard for Motor Car Maintenance, P. L. Dumas. Motor Age, vol. 41, no. 14, Apr. 6, 1922, pp. 30-36, 11 figs. [illegible] rigid inspection. Serious consequences of trivial omissions. Function of log book, tolerance sheet and timing [illegible]

Transmission Production. An Efficient Method of Transmission Production, J. Edward Schipper. Automotive Industries, vol. 46, no. 16, Apr. 20, 1922, pp. 869-872, 13 figs. Methods employed in Hudson and Essex Transmission Dept. Drilling of cases and machining of gear blanks accomplished by labor-saving methods. Gears matched for best mesh by special testing device.

AVIATION

Aerial Navigation. The Basic Principles of Aerial Navigation (Ueber die Grundlagen der Nautik des Luftmeeres), Conrad Harmsen. Schiffbau, vol. 23, nos. 14, 15, 17 and 18, Jan. 4, 11, 25 and Feb. 1, 1922, pp. 403-408, 435-439, 495-501 and 533-538, 10 figs. Study based on author's experiences during war. Comparison of general nautical and aeraunotical principles. Discussion and graphic solution of three most important problems of aerial navigation.

Maps and Navigation. Maps and Navigation Methods, A. Duval. Aerial Age Weekly, vol. 15, no. 9, May 8, 1922, pp. 198-199. International agreement as to maps and merits of flying by compass rather than landmarks. From Preimer Congrès International de la Navigation Aérienne, Nov. 1921.

B

BATTERIES

Copper Oxide Cell. New Type of the Copper Oxide Cell (Nouveau modèle de pile regénérable à l'oxyde de cuivre) Maurice Leblanc. Bul. de la Société Française des Electriciens, vol. 1, no. 10, Dec. 1921, pp. 427-434, 2 figs. Compares it with manganese dioxide cell, and concludes that it may replace latter especially when a constant tension or a great voltage intensity is required.

BAUXITE

Adriatic. Eastern Adriatic Bauxites (Beitrag zur Kenntnis der ostadriaticshen Bauxite) Fritz Kerner-Marilaun. Berg.-und Hüttenmännischles Jahrbuch vol. 69-70, no. 1, 1921-22, pp. 73-78, 2 figs. Discusses the various types of bauxites, the Sedramic, Domanovic, Kalun, Medvid, Imotski, Blizanzi and Grislic, their geology and extent of occurrence.

BEAMS

Continuous. Method for Calculating Lines of Influence of Bending Moments of Continuous Beams (Verfahren zur Ermittlung von Einflusslinien der Biegungsmomente durchlaufender Träger), H. Kayser. Beton u. Eisen, vol. 21, no. 4, Feb. 23, 1922, pp. 56-60, 12 figs. Describes simple method of calculating lines of influence for beams with unsymmetrical opening having no particular ratio to one another and for varying moments of inertia.

T-Shaped Cross-Sections. Method for Measuring T-Shaped Cross-Sections (Bermessungsverfahren für T-förmigen Querschnitt), Franz Kardos. Beton u. Eisen, vol. 21, no. 4, Feb. 23, 1922, pp. 62-65, 4 figs. Presents chart for measurement of t-shaped cross-sections and describes its applications.

BEARING METALS

Babbitt, Pouring Temperature for. Definite Temperature Control Nesessary in Babbitt Pouring. Karl F. Smith. Elec. World, vol. 79, no. 18, May 6, 1922, pp. 886-887. Challenge of article on "Suggestions on Rebabitting Bearings," by M. M. Brown, p. 434 of Elec. World, Mar. 4.

BEARINGS

Frictional Resistance of Lubricated. The Synthetic Calculation of Frictional Resistance of Lubricated Bearings (Die synthetische Berechnung der Reibungswiderstände geschmierter Lager, Etc.), W. v. Dallwitz-Wegner. Zeit. für technische Physik, vol. 3, no. 1, 1922, pp. 21-28, 8 figs. Calculation to determine properties of lubricating oil, based on internal friction or lubricating oil and capillary properties of oil and bearing metal.

Unsymmetrical. Pressures in Unsymmetrical Bearings, A. W. Knight. Machy. (Lond.), vol. 19, no. 496, Mar. 30, 1922, pp. 789-790, 2 figs. Makes calculations from which it is concluded that it is bad practice to use unsymmetrical bearings of whatever proportions.

BELTING

Care and Splicing. Splicing and Care of Leather, Rubber and Canvas Belts, G. H. Radebaugh. Coal Age, vol. 21, no. 17, Apr. 27, 1922, pp. 687-690, 25 figs. Oak-tanned leather preferable for power transmission; why short-lap belt is recommended; tallow and cod-liver oil make good dressing; cement, wire and raw hide fastenings.

Leather. Leather Belt Research Conclusions, J. Edgar Rhoads. Can. Mfr., vol. 42. no. 4, Apr. 1922, pp. 25-26. Manufacturers have conducted investigations into various phases of uses of leather belting, results of which are outlined.

V-Type. New Belt That May Revolutionize Drives to Light Machinery, Roger Fison. Belting, vol. 20, no. 4, Apr. 1922, pp. 26-28, 1 fig. Due to greater friction surface and flexibility this type can transmit much greater power under less tension than round belt. Hints on other sizes.

Widths, Relative Capacity. Relative Capacity of Leather Belts of Different Widths, Belting, vol. 20, no. 4, Apr. 1922, pp. 36-38, 1 fig. Experiments by R. S. Jones of Leather Belting Exchange Foundation, Cornell Univ. Power transmitted increased from 22 at end of 9 hr. to 57 at end of 47½ hr. Capacity apparently varies directly with width.

BLAST-FURNACE GAS

Cleaning. Economy of Modern Blast-Furnace-Gas Cleaning Processes in the Rhur and Minette Districts (Wirtschaftlichkeit neuzeitlicher Hochofengasreinigungen im Rhur- und Minettebezirk), Max Schlipköter. Stahl u. Eisen, vol. 42, nos. 8 and 11, Feb. 23 and Mar. 16, 1922, pp. 285-290 and 408-422, 4 figs. 1 on supp. plate. Advantages of use of finely purified gases in air heating. Influence of water content of gases. Requirements of blast-furnace gas for economical operation. Determination of operating costs of cleaned gases based on practical examples with different cleaning processes. Advantages of dry filter process.

BLAST FURNACES

Oxygen Admixture to Air. The Admixture of Oxygen to Blast in Blast-Furnace Plants (Verwendungsmoglichkeiten der Lindeluft in Hochofenbetrieben), Theodor Wagner. Stahl u. Eisen, vol. 42, no. 12, Mar. 23, 1922, pp. 456-460. Notes on earlier opinions and experiments; changed conditions in blast-furnace practice since war; reduction of coke charge and introduction of producer gas

or pulverized coal through tuyeres [illegible] blast furnaces with pulverized coal heating.

BOILER FEEDWATER

Preheating. Preheating of Locomotive Feedwater (Les réchauffeurs de eau d'alimentation des locomotives). Génie Civil, vol. 80, no. 14, Apr. 8, 1922, pp. 320-324, 8 figs. Compares open and closed types and discusses American practice.

Regulator, Automatic. Hydraulic Feed-Water Automatic Regulator. Mar. Engr. and Naval Architect, vol. 45, no. [illegible], Apr. 1922, pp. [illegible]. Some features of new Aster-Anthony hydraulic feed-water regulator.

Self-Cleaning Evaporator Coils. Self Cleaning Evaporator Coils. Am. Mar. Engr., vol. 17, no. 5, May 1922, p. 33. Reilly evaporator, submerged type, self-cleaning coil solved problem of accumulation of salt scale.

BOILER FIRING

Brown Coal. Boiler Firing with Brown Coal (Feuerungsanlagen fur Rohbraunkohlen), O. Binder. Wärme- u. Kalte-Technik, vol. 24, no. 6, Mar. 15, 1922, pp. 65-67, 4 figs. Suitable firebox and grate arrangements; mechanical stoking; etc.

Peat. Pure and Mixed Peat Fuel for Boiler Firing (Reine und gemischte Torffeuerung in Dampfkesselfeuerungen). Rauch u. Staub, vol. 12, no. 6, Mar. 1922, pp. 53-56. Adaptation of firebox conditions to burning of peat, and advantages of peat in firing with brown coal and other low-grade fuels.

Peat. Firing Peat Under Boilers With Inclined Grate and Automatic Stoking (Die Verfeuerung von Torf in einer Schrägrost-Beschickung unter Luftabschluss), W. Ledler. Wärme, vol. 45, no. 10, Mar. 10, 1922, pp. 121-124, 2 figs. Describes furnace built by Varel Iron Wks., near Oldenburg, and gives results of number of evaporation tests.

BOILER OPERATION

Load Indicators. Indicating Station Load in the Boiler Room, [illegible]. Power, vol. 55, no. 15, Apr. 11, 1922, pp. 579-580, 4 figs. Automatic load indicator is described which has made it possible to hold steam pressures within prescribed limits under fluctuation loads and practically to prevent safety valves popping off.

BOILERS

Cleaning. Cleaning Boilers by Means of Sand-Blast Apparatus (Reinigung von Dampfkesseln durch Sandstrahlgebläse), W. Kaempfer. Technische Blätter, vol. 12, no. 15, Apr. 14, 1922, pp. 153-154, 6 figs. Describes various experiences, especially with cleaning locomotive boilers; process requires about 200 kg. of sand per hr.

Furnace. *See Furnaces, Boiler.*

Locomotive. *See Locomotive Boilers.*

Treatment of Water. Boiler Water, C. E. Joos and A. W. Binns. Power Plant Eng., vol. 26, nos. 9 and 10, May 1 and 15, 1922, pp. 456-460 and 511-514, 23 figs. May 1: Up-to-date methods of eliminating impurities which cause trouble in boilers. May 15: Priming, its causes and their relative importance; continuous determination of steam quality.

Upkeep of Idle. Upkeep of Idle Boilers (La conservation des chaudières en chômage), V. Kammerer. Bul. des Associations Françaises de Propriétaires d'Appareils à Vapeur, no. 3, Jan. 1921, pp. 133-138. Precautionary measures to keep out rust, contact with air or water, etc.

BRASS

Cold Strip Rolling. American Practice in Cold Rolling Brass Strip, C. E. Davies. Metal Industry (Lond.), vol. 20, no. 13, Mar. 31, 1922, pp. 293-297, 2 figs. Points out that main points of difference in American from English practice are (1) machining or overhauling cast ingot before rolling; (2) increased rolling speeds; and (3) improved methods and appliances for handling and cleaning metal.

BRICK

Sand-Lime. The Manufacture of Lime Sand Bricks, C. Naske. Eng. Progress, vol. 3, no. 4, Apr., 1922, pp. 81-84, 5 figs. Manufacturing process from sand and lime to finished brick.

BRICKMAKING

Burning Shale Brick. Burning Shale Brick, L. B. Rainey, Brick & Clay Rec., vol. 60, no. 9, May 2, 1922, pp. 693-695, 5 fig. Discusses various stages of burning, production of colours, reduction of scum, value of pyrometer and cones and speeding up kiln turnover. Paper read before Eastern Red Div. of Am. Face Brick Assoc.

BRIDGES

Maximum Load for Materials. Admissible Loads on Bridge Materials (Zulässige Inanspruchnahme der Brukenbaustoffe), Wilhelm Hauser. Zeit. des Osterr. Ingenieur- und Architekten-Vereines, vol. 74, no. 13-14, Mar. 31, 1922, pp. 63-64. Calculation of maximum load; gives table of value.

Concrete. Highway Bridges Over Spillways of Dams of Miami Conservancy District. Eng. and Contracting, vol. 57, no. 17, Apr. 26, 1922, pp. 393-394, 3 figs. Deck girder type concrete bridges which span all five dams.

BRIDGES, CONCRETE

Arch. Design Features of Concrete Arch Bridge at Winnipeg. Eng. and Contracting, vol. 57, no. 17, Apr. 26, 1922, pp. 398-401, 2 figs. Proportion of parts forming an harmonious whole and mental process involved makes this bridge of unusual interest.

Pressure, Distribution in Girders. Distribution of Pressure in the Separate Girders of Concrete Bridges. (Die Druckverteilung auf die einzelnen Träger der Betonbrücken), Maximilian Thullie. Beton u. Eisen, vol. 21, no. 4, Feb. 23, 1922, pp. 67-70, 6 figs. Describes graphic method of calculation pressures developed by author which, though only approximate, is said to be sufficiently accurate and much simpler than Kögler's numerical method.

BRIDGES, HIGHWAY

Concrete. Concrte Used in Larger Highway Bridges. Eng. World vol. 20, no. 5, May 1922, pp. 292-294, 3 figs. Practical and ornamental advantages of this type of structure.

Prairie du Sac, Wis. Constructing Prairie du Sac Highway Bridge. Pub. Works, vol. 52, no. 18, May 6, 1922, pp. 311-313, 3 figs. Cofferdam construction of piers and erection of steel by derick-car and traveler for 18 plate girder spans. Concrete plant for substructure traveled on long trestle falsework.

BRIDGES, LIFT

Bascule. An Electrically Controlled Bascule Bridge. Electrician, vol. 88, no. 2292, Apr. 21, 1922, pp. 471-472, 2 figs. Description of installation at King GEORGE V dock, N. Woolwich, by Port of London Authority.

BRIDGES, RAILWAY

Loading and Maximum Stresses. The Work of the Indian Railway Bridge Committee, Ry. Engr., 42 and 43, nos. 503, 504, 505, 507, Dec. 1921, Jan., Feb. and Apr. 1922, pp. 446-447, 11-12, 71-74 and 138-139, 9 figs. Report of committee appointed to revise standards bridge rules as to loading and maximum stresses. Dec.: Indian Ry. loading tables. Jan.: Question of working stresses. Feb. Question of Impact and vibration. Apr.: Transmission of pressure through earth.

BROACHES

Full. The Design of Full Broaches. Machy. (Lond.), vol. 20, no. 497, Apr. 6, 1922, pp. 13-15, 4 figs. Depth of cut; pitch of teeth; length; shape of teeth; methods of attaching broaches to machines.

BRONZES

Cast, Analysis of. Notes on the Analysis of Cast Bronze, G. E. F. Lundell and J. A. Scherrer. Jl. of Indus. & Eng. Chem., vol. 14, no. 5, May 1922, pp. 426-429. Desirable procedures and precautions often ignores. Based on work done at Bur. of Stand. and by co-operating analysts.

C

CABLES

Laying Method. The Mangnall-Irving Thrust-Borer. Elec. Rev. (Lond.), vol. 90, no. 2317, Apr. 21, 1922, pp. 545-516, 5 figs. Describes machine whose object it is to eliminate trenching and tunnelling when laying pipes, cables, etc. Method employed is to bore horizontal holes through ground below surface, between pits sunk at required distance apart.

CAISSONS

Reinforced-Concrete. Reinforced- Concrete Caissons for Compressed Air Foundation Work (Caissons en beton armé, pour fondations à l'air comprimé), J. Eugenio Ribera. Génie Civil, vol. 80, no. 14, Apr. 8, 1922, pp. 318-320, 9 figs. Discusses advantages over metal caisson and describes some recent applications.

CALORIMETRY

Bomb Corrosion. The Effect of Bomb Corrosion on the Accuracy of Calorimetric Determinations, H. L. Olin and R. E. Wilkin. Chem. & Met. Eng., vol. 26, no. 15, Apr. 12, 1922, pp. 694-696. Describes experiments made with nickel-lined bombs.

CALORIMETERS

Continuous-Flow. A Continuous-Flow Calorimeter, and the Determination of the Heat of Neutralization of a Solution of Hydrochloric Acid by one of Sodium Hydroxide, Frederick G. Keyes, Louis J. Gillespie and Shinroku Mitsukuri. Am. Chem. Soc. Jl., vol. 44, no. 4, Apr. 1922, pp. 707-717, 3 figs. Describes experiments carried out and apparatus used.

CAMS

Calculation. Calculation of Cams (Calcul des cames), Octave Lepersonne. Technique Automobile et Aérienne, vol. 12, nos. 113 and 114, 1921, pp. 33-42 and 68-71, 15 figs. No. 113: Discusses theory, determination of geometric form, application of straight line and arc profiles. No. 114: Graphic calculation and numerical examples.

CANALS

St. Lawrence Project. The St. Lawrence Seaway, W. L. Saunders, Am. Inst. Elec. Engrs. Jl., vol. 41, no. 5, May 1922, pp. 379-382. Many arguments in favour including quotations from recognized sources.

CARS

Design Problems. Springs, Draft Gears and Other Problems in Car Design, Louis E. Endsley. Ry. Rev., vol. 70, no. 17, Apr. 29, 1922, pp. 591-594, 3 figs. Shorter spring travel and longer draft gear travel suggested as solution to most serious problem. Address before Virginia Section of A.S.M.E.

CAST IRON

Early History. The Early History of Iron with Special Reference to Cast Iron, J. Newton Friend. Foundry Trade Jl., vol. 25, nos. 290-291 and 292, Mar. 9, 16 and 23, 1922, pp. 182-183, 193-194 and 216-218, 9 figs. Discusses iron in Egypt and Palestine, Mesopotamia, Europe, Great Britain and Central Africa; direct reduction of iron ores; reduction of iron in Africa; discovery of cast iron; 18th century developments.

Mechanical Tests. Mechanical Tests of Cast Iron (Considérations générales sur les essais mécaniques des fontes), M. Portevin, Revue Universelle des Mines, vol. 12, no. 6, Mar. 15, 1922, pp. 507-511. Discusses the various tests available and shows that some, such as the impact test, are of no value. Recommends tensile strength and Brinell tests.

CEMENT

Canadian Specifications. New Cement Specifications, Canadian Engineering Standards Association. Can. Engr., vol. 42, no. 17, Apr. 25, 1922, pp. 428-429. Résumé of new report from Can. Standards Assn. based also on specifications of Eng. Inst. of Canada, Am. Soc. for Testing Matls., and Brit. Standards for Portland Cement.

Fused. Fused Cement (Le ciment fondu). Vie Technique et Industrielle, vol. 3, no. 30, Mar. 1922, pp. 503-506, 4 figs. Discusses French process for making cement containing 10 per cent silica, 40 alumina, 10 iron oxide, 40 lime, raised to temperature of complete fusion, and its properties and characteristics.

HARDENING. Experiments on the Effect of Low Temperatures on the Hardening of Cement (Versuche über die Einwirkung von niedrigen Temperaturen auf das Erhärten des Zements), H. Kreüger. Beton u. Eisen, vol. 21, no. 5, Mar. 18, 1922, pp. 74-78, 4 figs. Discusses tests with cement cubes to show effect of freezing temperature and draws number of conclusions.

CEMENT MILLS

JAPANESE. A Modern Japanese Cement Plant. Rock Products, vol. 25, nos. 8 and 9, Apr. 22, and May 6, 1922, pp. 38-43, and 36-39 25 figs. Description of 5,000 barrel capacity per day plant of Assano Co. at Kawasaki, Japan.

CENTRAL STATIONS

HEATING AND POWER. Investigating the Efficiency of a Central Heating and Power Station (Wirtschaftliche Untersuchungen an einem Fern-Wärmekraftwerk), M. A. Nüscheler. Gesundheits-Ingenieur, vol. 45, no. 13, Apr. 1, 1922, pp. 169-177, 5 figs. Author's experience in construction and operation of steam piping for central heating stations, either in connection with central power stations or without it.

INSTALLED GENERATOR RATING, U.S. Rating of Generators in Central Stations Totals 14,466,915 Kw. Elec. World, vol. 79, no. 14, Apr. 8, 1922, pp. 670-679, 1 fig. Analysis of centra-station development indicates total of 5532 electric generating plants, of which almost 65 per cent are privately owned. Hydroelectric plants total 1421.

SUPER-POWER. Super-Power System for Japan, C. A. Powel. Elec. Rec., vol. 31, no. 5, May 1922, pp. 357-359, 1 fig. Program for furnishing electricity over large area between Tokio and Osaka.

SUPER-POWER PROJECT. Hoover Sees Super-Power Project as Possible Stabilizer of Coal Industry. Min. Congress Jl., vol. 8, no. 5, May 1922, pp. 729-730. Theory that project in Atlantic Coast region between Washington, D.C. and Portland, Me., night stabilize coal industry.

CERAMIC INDUSTRY

FELDSPAR INDUSTRY. Conditions in the Feldspar Industry, Raymond B. Ladoo. Raw Material, vol. 5, no. 4, May 1922, pp. 150-154, 10 figs. This important non-metallic mineral, main ingredient in enamel and largely used as flux in abrasive manufacture.

CHEMICAL PLANTS

FOG DISSIPATION. Fog Dissipation Plants for Chemical Factories (Entnebelungsanlagen in chemischen Fabriken), P. Martell. Chemiker-Zeitung, vol. 46, no. 44, Apr. 13, 1922, pp. 333-334, 3 figs. Describes device consisting of a heating apparatus and a low-pressure centrifugal fan which can be driven by electric motor or from a shaft.

CHIMNEYS

HEAT LOSSES IN. The Relation Between CO_2 and Stack Losses. Power Plant Eng., vol. 26, no. 8, Apr. 15, 1922, pp. 429-431, 3 figs. Discusses various factors governing chimney loss, and shows that the magnitude of chimney loss bears definite relation to percentage of CO_2 in flue gases.

CHLORIDIZING

VOLATILIZATION. Heat Requirements of Chloridizing Volatilization, Oliver C. Ralston. Eng. and Min. Jl.-Press, vol. 113, no. 15, Apr. 15, 1922, pp. 614-615. Criticism of statements made by the late Harai R. Layng.

CLUTCHES

MAGNETIC. Magnetic Clutches in the Cement Industry, W. H. Costello. Am. Inst. Elec. Engrs. Jl., vol. 41, no. 5, May 1922, pp. 361-363, 2 figs. Clutch requirements and description of magnetic type which meets them.

COAL

ANALYSIS. Coal Analysis May Be Misleading Because of Crude and Insufficient Sampling, O. P. Hood. Coal Age, vol. 21, no. 12, Mar, 23, 1922, pp. 484-486. Advises averaging of numerous samples taken over long period to get representative value. Based on address before Nat. Assn. Purchasing Agents.

COKING PROPENSITIES. The Coking Propensities of Coals, W. A. Bone, A. R. Pearson, E. Sinkinson, W. E. Stockings, Gas World, vol. 76, no. 1967, Apr. 4, 1922, pp. 16-20, 1 fig. Results of experimental investigations into resinic constituents of bituminous coals and their supposed determining influence upon coking propensities of coals. (Abstract). Paper read before Royal Soc.

COMBUSTION. Combustion of Coal, R. B. MacMullin. Combustion, vol. 6, no. 3, Mar. 1922, pp 118-123, 5 figs. Composition and classification of coal; oxidation of carbon.

COAL GAS

ECONOMICAL USE. Economical Use of Illuminating Gas (L'emploi économique du gaz d'éclairage), R. Villers. Nature, no. 2500, Mar. 4, 1922, pp. 134-138, 7 figs. Various uses of the gas; types of burners; proper mixing with air; compressing

COAL HANDLING

BUNKERING CRANES. Recent Developments in Bunkering Cranes, Cargo, Coal Loading Equipment and Shipbuilding Cranes, Justin Griess. World Ports, vol. 10, no. 6, Apr. 1922, pp. 47-55. Describes methods for bunkering coal at various harbours.

EQUIPMENT. Coal and Ash-Handling Equipment, Harry R. Westcott, Steam, vol. 29, no. 4, Apr. 1922, pp. 93-100. Description of various units from yard storage through traveling bridges, feeders, chain elevators and conveyors to ash hoppers.

COAL MINES

SHAFT-BOTTOM RELINING. Relining a Shaft-Bottom with Reinforced Concrete, T. Crosby. Iron and Coal Trades Rev., vol. 104, no. 2821, Mar. 24, 1922, pp. 413. Describes operation in detail; adoption of reinforced-concrete justified by prohibitive price of best brick. From paper read before Yorkshire County Colliery Under-Mgrs'. Assn.

COAL STORAGE

METHODS. Coal Storage (La Conservation des charbons), E. Schmidt. Bul. des Associations Françaises de Propriétaires d'Appareils à Vapeur, no. 4, Apr. 1921, pp. 165-181. Discusses change in coal exposed to air, spontaneous combustion, storage under water, coal piles, etc.

COKE BREEZE

STEAM GENERATION. The Utilization of Coke Breeze for the Generation of Steam, W. Francis Goodrich. Gas Engr., vol. 38, no. 550, Feb. 15, 1922, pp. 44-46. Features of this fuel which make it of real value.

COMPRESSED AIR

MINES. Determining the Drop in Pressure in Compressed Air Piping in Mines (Ermittlung des Druckabfalls in Pressluftleitungen untertage), W. Reinhard. Glückauf, vol. 58, no. 15, Apr. 15, 1922, pp. 433-436, 1 fig. Discusses drop due to pipe resistance, and gives chart from which average loss of head can be calculated.

CONCRETE

REINFORCED AND NON-REINFORCED. Reinforced and Non-Reinforced Concrete (Gewapend- en ongewapend beton in de versterkingskunst), J. H. de Man. Ingenieur, vol. 37, no. 12, Mar. 25, 1922, pp. 210-231, 44 figs. Discusses concrete work with and without reinforcing for military defensive purposes, effect of heavy shells, etc., and gives examples of various forts.

CONCRETE CONSTRUCTION, REINFORCED

MONOLITHIC STRUCTURES. Secondary Stresses in Monolithic Structures and How to Calculate Them, R. J. Harrington Hudson. Indian Eng., vol. 71, no. 9, Mar. 4, 1922, pp. 122-124, 12 figs. on supp. plate. Discusses new method of investigating stresses in monolithic reinforced-concrete structures.

CONDENSERS

STEAM. Season Cracking in Condenser Tubes. Power Plant Eng., vol. 26, no. 9, May 1, 1922, pp. 461-462, 6 figs. Cracking of tubes. Study of costs and suggestions toward elimination.

CONDENSERS, ELECTRIC

POWER FACTOR, FOR INCREASING. Increasing the Power Factor by Means of Condensers (Le relèvement du facteur de puissance par les condensateurs), Catulle-Cambier. Electricien, vol. 52, no. 1286, Oct. 15, 1921, and vol. 53, nos. 1922 and 1293, Jan. 15 and Feb. 1, 1922, pp. 457-461, 25-29 and 58-66, 19 figs. Oct. 15: Calculation of capacity of condensers for various cases. Jan. 15: Discusses influence exerted by condensers in the various elements. Feb. 1: Discusses direct influence of capacity on power factor, and gives chart for finding it; connecting batteries; short circuits; etc.

CONDUITS

BUILT-IN-PLACE GUNITE. Built-in-Place Gunite Water Conduit. Contract Rec., vol. 63, no. 18, May 3, 1922, pp. 398-402. Unusual design and cement gun construction produce economical low head conduit details, costs and solutions of special problems.

CONVEYORS

BELT. Biggest Belt-Conveyor System in the World, D. R. Egbert. Belting, vol. 20, no. 4, Apr. 1922, pp. 17-25, 5 figs. Parcel-post station in Chicago to be completed June 1922, will have 8 miles canvas-stitched belting. Description of installation, largest in world.

MONORAIL. Monorail Conveyors on Clay Plants. Brick and Clay Rec., vol. 60, no. 8, Apr. 18, 1922, pp. 613-615, 9 figs. This type desirable for clay plants. Description of installations at R. Thomas & Sons, East Liverpool, Ohio, and Brooklyn (Ind.) Brick Co.

STEEL-BELT. Steel-Band Conveyors. Eng. Process, vol. 3, no. 5, May 1922, pp. 109-110, 13 figs. Application and advantages of steel-band conveyors of Sandviken type.

STEEL-BELT. Flexible Steel Belt Conveyors, Harry Carlson. Gas Age-Rec., vol. 49, no. 13, Apr. 1, 1922, pp. 383-385, 6 figs. Describes steel belt made by Sandviken Steel Works, Sweden, and gives particulars as to strength, corrosion, loading width, etc.

TELPHERS VS. Telphers vs. Conveyors for Gas Works Purposes, Herbert Blyth. Gas Engr., vol. 38, no. 549, Jan. 16, 1922, pp. 6-7, 2 figs. Features of gas manufacturing plant and conparative advantages of overhead and conveyor systems.

COPPER METALLURGY

PECHEY LEACHING PROCESS. Hydro-Metallurgy of Copper-The Pechey Leaching Process, J. D. Audley Smith, Chem. Eng. & Min. Rev. vol. 14, no. 162, Mar. 5, 1922, pp. 177-181, 5 figs. Description of this process which was first employed at Girilambone copper mine, New South Wales, by G. A. Pechey.

COPPER ORE

CHUQUICAMATA, SOUTH AMERICA. The Chuquicamata Ore Body (El mineral de Chuquicamata). Ingenieria Internacional, vol. 7, no. 5, May 1922, pp. 295-300, 8 figs. Reviews history of this copper deposit and methods employed in extracting low-grade ores.

ROASTING SEMI-OXIDIZED. Sulphatizing Roasting of Semi-Oxidized Copper Ores. PercyR Middleton. Eng. &Min. Jl.Press, vol.113, no.15, Apr.15,1922,pp.529-631, 4 figs. Process so conducted as to produce maximum content of water-soluble copper; close temperature regulation necessary.

TREATMENT OF POOR. Treatment According to the Wet Process of Copper-Poor Oxide Ores Rich in Lime and Magnesia (Die Verarbeitung kupferarmer, kalk- und magnesishaltiger, oxydischer Erze auf nassem Wege), Alfred S Schott. Metall u Erz, vol 19, nos. 4, 5 and 6, Feb. 22, Mar 8, and 22, 1922, pp 85-92, 112-119 and 140-152, 13 figs. Review of tests and results obtained with ammonia lixiviation. Cyanide of potassium as lixiviating medium for copper ores.

CORROSION

COLLOIDS, INFLUENCE OF PROTECTIVE. The Influence of Protective Colloids on the Corrosion of Metals and on the Velocity of Chemical and Physical Change, John A. N. Friend and Reece H. Vallance. Chem. Soc. Jl., vol. 121-122, no. 713, Mar. 1922, pp. 466-474, 2 figs. Concludes that after a general law protective colloids tend to retard velocity of such reactions as involve change of state from solid to liquid, or vice versa, in one or more of the components.

FERROUS METALS. Corrosion of Ferrous Metals, Robert Abbott Hadfield. Metal Industry (Lond.), vol. 20, no. 16, Apr. 21, 1922, pp. 381-382. Preparation of various ferrous metals used in corrosion research of Inst. Civil Engrs. together with their physical and mechanical properties and some general considerations on subject of corrosion. (Abstract). Paper read before Inst Civil Engrs

Rust Prevention. The Prevention of Rust. Motor [illegible], vol. 34, no. [illegible], May 1, 1922, p. 529, 1 fig. Notes on [illegible] process for protecting certain parts of motor vehicles [illegible].

Oxidization Prevention. Calorizing and [illegible], H. H. [illegible] and C. R. Brophy. Gen. Elec. Rev., vol. 25, no. 5, May 1922, pp. [illegible], [illegible] figs. Description of process developed in Schenectady Research Laboratory to prevent corrosion.

COST ACCOUNTING

Depreciation and Retirement of Property. Depreciation and Retirement of Property, William H. Bell. Jl. of Accountancy, vol. 33, no. 4, Apr. 1922, pp. 253-258. Shows that where average rate of depreciation is used, if a unit of property is retired in advance of average estimated life, all contents less entire cost of unit retired should be charged to reserve for depreciation.

Engineering Methods applied to. Engineering Methods Applied to Cost Finding, Robert S. Denham. Indus. Management, vol. 63, nos. 2, 3, 4 and 5, Feb., Mar., Apr. and May, 1922, pp. 67-73, 161-166, 218-220, and 310-312, 4 figs. Feb.; Effect upon profit margin of traditional and misleading cost methods. Mar.: General principles underlying application of expense items. Apr.: Six fundamental principles of cost engineering. May: Definite procedure for surveying the requirements of production.

New Plan. Cost Accounting, Guy Foote Wetzel. Armour Engr., vol. 13, no. 3, Mar. 1922, pp. 163-174. Discusses cost accounting plan with some new features by A. W. Torbet, installed in large manufacturing plant, and compares with usual methods.

Scientific, Necessity for. Costing in Industry. Eng. & Indus. Management, vol. 7, no. 12, Apr. 20, 1922, pp. 357-360. First part of special report of Costing Conference held in Lond., covering cost accountant's position, works expenditure, periodical comparisons, and productive labor.

CRANES

Classification. Classification of Hoisting Machines Particularly Cranes (Einteilung der Hebe- und Transportmaschinen, insbesondere der Krane), R. Dub. Fördertechnik u. Frachtverkehr, vol. 15, nos. 1 and 2, Jan. 6 and 20, 1922, pp. 1-4 and 22-26, 59 figs. Classification of the various types of cranes into groups according to their kinematic characteristics, assuming that load is always concentrated at center of gravity.

Floating. A 60-ton Floating Crane, W. Fox. Mech. World, vol. 71, nos. 1837 and 1838 Mar. 17 and 24, 1922, pp. 207-209 and 224-226, 10 figs. Describes in retail revolving jib type floating crane, built by Werf Gusto (Firma A. F. Smulders), Schiedan, Holland.

Inspection. Things that the Crane Inspector Looks for and Some of the Hows and Whys, A. L. Gear. Elec. Rev. & Indus. Engr., vol. 80, no. 3, Mar. 1922, pp. 111-118, 152, 14 figs. Inspection report forms and things looked for in making inspection.

CRANKSHAFTS

Steel for. Steel for Crankshafts: Its Heat Treatment, H. C. Loudenbeck. Forging and Heat Treating, vol. 8, no. 4, Apr. 1922, pp. 181-183. Grades of steel that are being used for this purpose, and their heat treatment and physical properties to secure best results.

CUPOLAS

Charging Elevator, Combined with. An Improved Foundry Melting Plant. Engineer, vol. 133, no. 2457, Mar. 31, 1922, pp. 365-366, 3 figs. Describes plant designed by J. E. Hurst for regular production of high-grade cast iron for use in manufacture of castings by centrifugal-casting process. Consists of a cupola an elevator charging arrangement and an oil-fired receiver.

Design and Operation. Iron and Foundry Cupola Management, J. J. McClelland. Foundry Trade Jl., vol. 25, no. 292, Mar. 23, 1922, pp. 209-213, 5 figs. Author's experience in cupola practice; describes lay-out of plant, construction of cupola, linings, charging, fans or blowers, etc. Paper read before Inst. British Foundrymen.

Iron Melting. Cupola Practice, J. Wood. Foundry Trade Jl., vol. 25, nos. 296 and 297, Apr. 20 and 27, 1922, pp. 288-290 and 204-306, 3 figs. Some difficulties that have to be overcome in melting iron by cupola process which, for quickness and cheapness, is not excelled by any other furnace. Details of lining and tuyeres. Paper read before Instn. British Foundrymen.

D

DAMS

Artificial Lakes. Cloudbursts and Artificial Lakes (Nubifragi e Laghi artificiali), Vittorio Montanari. Annali del Consiglio Superiore delle Acque, vol. 3, no. 2, 1921, pp. 73-77. Calculates stresses for a dam at maximum water level and above, especially for disastrous cloudbursts.

Construction Kettle Creek, St. Thomas. Construction of Kettle Creek Dam, St. Thomas, W. C. Miller and G. H. Chalmers. Can. Engr., vol. 42, no. 18, May 2, 1922, pp. 444-447, 6 figs. Further development of Kettle Creek for water supply for St. Thomas, Ont. Scheme proposed by engineer. Exhaustive inquiry into rain fall and run-off conditions. 400,000,000-gallon capacity dam.

Gilboa Construction. Gilboa Construction. Gilboa Dam Construction. Pub. Works, vol. 52, nos. 12, 17, 18, Mar. 25, Apr. 29 and May 6, 1922, pp. 205-208, 295-297 and 319-321, 6 figs. Mar. 25: Exploration boring pressure tests, river diversion, foundations excavations and installation of contractor's plant. Apr. 29: Quarries, sand pits, washings and screenings, concrete mixing and placing. May 6: Steenkill dike and appurtenances; foundation, excavation, controll channell, steam shovel and belt conveyor work for large embankment. bypass pipes and flume, repairing culvert and paving slope.

Multiple-Arch. Multiple Arch Dams for Artificial Lakes (Laghi artificiali e dighe ad archi multipli), L. Kambo. Annali del Consiglio Superiore delle Acque Pubbliche, Ministero dei Lavori Pubblici, vol. 3, no. 2, 1921, pp. 31-69, 35 figs. partly on supp. plate. Discusses construction with in river Tirso in Sardinia, including dam, calculation of arches, temperature differences, etc.

Overfall Segments, Influence of. The Influence of Overfall Segments on the Dimensions of Dams (Der Einfluss von Ueberfallausschnitten auf die Abmessungen von Sperren), Leo Hauska. Zeit. des Oesterr. Ingenieur- u. Architekten-Vereines, vol. 74, nos. 5-6 and 7-8, Feb. 3 and 17, 1922, pp. 31-33 and 37-38, 4 figs. Investigation to determine proper dimension and economy of torrent-control structures.

DIESEL ENGINES

Flexibility. Diesel Engine Flexibility, W. S. Burn, Steamship, vol. 33, no. 394, Apr. 1922, pp. 320-331, 9 figs. Investigation with view to its application to direct-driven Diesel locomotive. It is shown that principles governing flexibility are practically identical with those governing economy. Read before Graduate Section of North-East Coast Instn. Engrs. & Shipbuilders.

Heavy and Low-Grade Oil. Using Heavy and Low Grade Oil in Motors of the Diesel Type (Minerta y Petroleo),, Benigno Benigni. Ingenieria, vol. 26, no. 3, Mar. 1922, pp. 133-135, 1 fig. Some experiments with Ansaldo San Giorgio engines running on cotton-seed and palm oils.

Lighter. Use Diesel Unit for Lighter. Mar. Rev., vol. 52, no. 5, May 1922, pp. 215-217, 3 figs. Installation of unit on derrick lighter Worthington, owned by Worthington, Pump & Machy. Corp. develops 300 b. hp. at 275 r.p.m.

Locomotive. Industrial, and Scientific Progress. Beama, vol. 10, no. 4, Apr. 1922, pp. 295-298. Description of air auxiliary cylinders with Diesel engine which give sufficient flexibility for use on locomotives; designed by W. S. Burn who presented paper on subject before N. E. Coast Instn. Engrs. and Shipbuilders.

DOCKS

Concrete. Concrete Docks Defy Teredo. Eng. World, vol. 20, no. 4, Apr. 1922, pp. 213-214, 5 figs. Describes new concrete structures in Pierce County, Washington, which have been found very satisfactory. First cost is about three times that of wooden pile structure.

DRAFT

Equalized. The Significance of Equalized Draft (Wesen und Bedeutung des ausgeglichenen Zuges), Hch. Doevenspeck. Wärme, vol. 45, no. 9, Mar. 3, 1922, pp. 111-113, 2 figs. Discusses natural and forced draft and advantages of equalized draft.

DRILLING MACHINES

Pneumatic. Pneumatic Drilling Machines and Hammers in Mining and Related Industries (Druckluft-Bohrmaschinen und -Hammer im Bergbau und in den verwandten Betrieben), R. Goetze. Zeit. des Vereines deutscher Ingenieure, vol. 66, nos. 11 and 12, Mar. 18 and 25, 1922, pp. 245-251 and 278-280, 42 figs. History of development and description of most important modern types of drilling machines, hammers and picks. Prospects of future development.

DRYDOCKS

Floating. A New Type of One-Sided Floating Dock Without Land Security. (Der neur Typ eines Seitenschwimmdocks ohne Landfesten des Hamburger Dockbau-Büros von Matthiessen & Muller). Schiffbau, vol. 23, no. 28, Apr. 12, 1922, pp. 857-859, 10 figs. Describes new type of dock patented by Mathiessen & Müller, Hamburg, which is said to bombine advantages of U- and L- shaped floating dock without disadvantages of L-docks. It consists of four pontoons, the center being longer than end pontoons.

Building Floating Drydocks, David W. Barnes. Pacific Mar. Rev., vol. 19, no. 4, Apr. 1922, pp. 238-240, 4 figs. Describes some dock construction work by Sun Shipbldg. Co. and Federal Shipbldg. Co., for docks of 8000 or 10,000 tons capacity.

DRYING

Wood. Note on Drying (Note sur le séchage), P. Villain. Revue de l'Industrie Minérale, no. 31, Apr. 1, 1922, pp. 155-170, 10 figs. General principles of drying methods as applied in mining and metallurgy, especially of woods.

DURALUMIN

Properties and Commercial Possibilities. Duraluminum Properties and Commercial Possibilities. Brass World, vol. 18, no. 4, Apr. 1922, pp. 129-130. Characteristics of this material, one-third the weight of cold-rolled steel though with same approximate strength.

Welding. Welding Duralumin — Some Experimental Work and Its Results, Horace C. Knerr. Automotive Industries, vol. 46, no. 18, May 4, 1922, pp. 964-968, 10 figs. Account of experimental work done at Naval Aircraft Factory and results attained from this work and from weld made by private firm. Details of tensile and corrosion tests made on different types of welds.

E

EDUCATION, INDUSTRIAL

Electricians. Practical Training and Professional Courses in the Electric Industries (Rôle de l'Ecole pratique et des Cours professionnels dans les industries électriques), E. Labbé. Revue Générale de l'Electricité, vol. 11, nos. 10 and 11, Mar. 11, and 18, 1922, pp. 367-372 and 405-414, 10 figs. Mar. 11: Kind of training best for practical industrial schools to train skilled electricians. Mar. 18: Machinery and apparatus necessary for instruction, and their practical operation.

ELECTRICAL MACHINERY

Synchronous Machines. Working of Synchronous Machines in Parallel (Das Arbeiten von Synchronmaschinen in Parallelbetrieb), H. Ossanna. Zeit. des Bayerischen Revisions-Vereins, vol. 26, no. 6, and 7 Mar. 31, and Apr. 15, 1922, pp. 41-44, and 49-51, 11 figs. Mar. 31. Discusses the mechanical problem, number of revolutions, and mechanical transmission, Apr 15: Discusses the electrical problem, dependence of performances on rotation characteristic, and their independence of voltage conditions in system.

ELECTRICAL MEASUREMENTS

High Frequency Generator. A Simple Generator of High Frequency Current for Measurement Purposes. Electrician, vol. 88, no. 2291, Apr. 14, 1922, pp. 436-438, 7 figs. Postulating importance of high frequency measurements in modern radio researches. Requirements of generator of high frequency current for this class of work and description of apparatus used for purpose. Examples of measurements given

Remote Power Indicating. Indicating the Total Power from Several Generating Stations, H. P. Sparkes. Elec. Jl., vol. 19, no. 4, Apr. 1922, pp. 142-146, 4 fih. Potentiometer system whereby load dispatcher has indicators showing immediate accurate loads at different stations without recourse to old telephone method.

ELECTRIC CIRCUITS

PROTECTIVE GEAR. The Use of Time-Lags. Major Kenelm Edgcumbe. Beama, Vol. 10, no. 4, April 1922, pp. 308-311, 4 fig. Relative advantages of instantaneous or delayed operation for protective gear.

ELECTRIC CURRENTS

SHORT CIRCUIT, TEMPERATURE STRESSES. Temperature Stresses Under Short-Circuit Currents, H. S. Holbrook. Elec. Rev. (Lond.) vol. 90, no. 2316, Apr. 14, 1922, pp. 512-513, 5 figs. Considered under temperature and current densities, short-circuit currents, and minimum size of current transformers.

ELECTRIC DRIVE

CHANGING FROM STEAM. Changing From Steam to Electric Drive. Wood-Worker, vol. 41, no. 2, Apr. 1922, pp. 38-39, 1 fig. In case cited herewith a large plant changes from steam to electric drive, but instead of scrapping old power-transmission equipment, latter is retained in sections which now constitute motor-driven group drives.

ELECTRIC FURNACES

ALUMINUM MELTING. Melts Aluminun in Electric Furnace, H. E. Diller. Foundry, vol. 50, no. 9, May 1, 1922, pp. 345-357, 10 figs. Daily and monthly operating reports indicate power required and other data. Core sand all reused; sand-driers prove economical; pattens fitted in wooden matches.

OPERATION. Changes in the Working of an Electric Furnace (Remarques au sujet des changements d'allure dans les hauts-fourneaux électriques), J. Seigle. Revue de Métallurgie, vol. 19, no. 2, Feb. 1922, pp. 86-89. Difference in blast and electric furnaces in reduction of oxides by carbon and formation of CO and CO_2.

ELECTRIC GENERATORS, A.C.

EXCITATION CURRENT. Experimental Determination of the Excitation Current of Alternators by the Potier Method (Prédétermination expérimentale du courant d'excitation des alternateurs par la méthode de Potier.), Omer de Bast. Assn. des Ingénieurs Electriciens Sortis de l'Institut Electrotechnique Montefiore Bul., vol. 1, no. 1, Jan-Feb. 1922, pp. 34-42, 5 figs. A simple and sufficiently exact method recommended in recently proposed French standards for electric material.

ELECTRIC LOCOMOTIVES

CHILE FREIGHT SERVICE. Electric Freight Locomotives for Chile. Ry. Age, vol 72, no. 17, Apr. 29, 1922, pp. 1005-1006, 2 figs. Work on fifteen for Chilean State Rys. nearing completion. Operated at 3000 volts d.c.; maximum speed, 40 m.p.h.; estimated weight, 226,000 lb.

SINGLE-PHASE, FRANCE. Single-Phase Electric Traction on the system of the Camargue R. R. Co. (Application de la traction électrique par courant monophasé sur le réseau de la Compagnie des Chemins de fer de la Camargue), J. Reyval. Revue Générale de l'Electricité, vol. 11, no. 10, Mar. 11, 1922, pp. 351-359, 12 figs. Discusses recently electrified lines Nîmes-Arles Trinquetaille and Nimes-Saint Gilles, and advantages derived; 6,600 volts, 25 cycle.

ELECTRIC MOTORS

STARTING PANEL. Solenoid Type Motor Starting Panel. Machy. (Lond.), vol 20, no. 500, Apr. 27, 1922, pp. 120-121, 2 figs. Description of new type of automatic control of electric motors, expecially in connection with machine-tool drives.

ELECTRIC PLANTS

ACCIDENT AT ONTARIO POWER CO. Accidents Cripple 159,000 Hp. of Ontario Hydro Units. Elec. World, vol 79, no 18, May 6, 1922, pp 895-896. Result of several million dollars loss from accident at Niagara Falls on Apr. 20. Preliminary theories as to cause.

HELL GATE STATION. Hell Gate—A Station of Many Features. Elec. World, vol. 79, no. 17, Apr. 29, 1922, pp. 821-827, 11 figs. Unusual features are turbine room next to river, phase isolation of all electrical equipment, alternating-current driven auxiliaries.

HUMANIZED. A Humanized Plant, R. C. Denny. Combustion, vol. 6, no. 5, May 1922, pp. 218-220, 4 figs. Cannon St. plant of New Bedford Gas & Edison Light Co. designed for best performance of man power and mechanical equipment and operating at 1.7 lb. of 14,000 B.t.u. New River Coal to the kw.

WINNIPEG RIVER. The Next Big Western Power Scheme. Contract Rec., vol. 63, no. 17, Apr. 26, 1922, pp. 372-375, 6 figs. Manitoban Power Co. actively developing Great Falls, Winnipeg River. Contracts let for two complete 28,000 hp. units. Complete capital cost will be less than $80 per hp.

ELECTRIC POWER

SCIENTIFIC APPLICATION TO FACTORY PROBLEMS. Applying Electricity Scientifically to Factory Problems, Louis F. Leurey. Jl. Electricity and West. Industry, vol. 48, no. 9, May 1, 1922, pp. 343-345, 3 figs. Example of what can be done in adapting electricity to special needs of a factory as illustrated by modern equipment and carefully planned layout of California and Hawaiian sugar plant.

ELECTRIC RAILWAYS

TRACK AND WIRING ON BRIDGE. Track and Wiring on Large Bridge. Elec. Ry. Jl., vol. 59, no. 14, Apr. 8, 1922, pp. 587-591, 11 figs. Describes overhead wire and track construction on new bridge across Housatonic River, which has just been completed by Connecticut Co.

ELECTRIC SWITCHES

CONCRETE CELL STRUCTURES. The Development of Concrete Cell Structures for Oil Circuit Breakers, Bus-Bars and Disconnecting Switches, A. F. MacCallum. Elec. Jl., vol. 19, no. 4, Apr. 1922, pp. 166-170, 5 figs. Latest features in protection of human life and electric equipment.

ELECTRIC TRANSMISSION LINES

CURRENT RELAY FOR PARALLEL LINES. A Current Relay for Parallel Line Protection, H. P. Sleeper. Elec. Jl., vol. 19, no. 4, Apr. 1922, pp. 153-155, 11 figs. New means for disconnecting a defective line without interrupting service. Known as type CD and works on induction principle.

MECHANICAL STRESSES. Mechanical Stresses in Transmission Lines, E. Maerker. Can. Engr. vol. 42, no. 17, Apr. 25, 1922, pp. 417-420, 7 figs. Chart developed [illegible] temperature for horizontal spans [illegible] to 1,500 ft. and supports at same or different elevations.

ELECTRODES

ZINC. The Effect of Changing Hydrogen-Ion Concentration on the Potential of the Zinc Electrode, Theodore W. Richards and Theodore Dunham, Jr. Am. Chem. Soc. Jl., vol. 44, no. 4, Apr. 1922, pp. 678-684, 1 fig. Studies effect of adding acid to salt solution around a typical easily and exactly reproducible metal electrode, in order to demonstrate experimentally sign and magnitude of potential difference thus caused.

ELECTROLYSIS

ANALYSIS BY. Electrolytic Analysis in Works Practice. Metal Industry, (Lond.) vol. 20, no. 14, Apr. 7, 1922, pp. 317-320, 4 fig. Methods by which metal contents can be determined.

EMPLOYEES' REPRESENTATION

WORKS COUNCILS. Industrial Representation and the Fair Deal. George H. Shepard. Indus. Management, vol. 63, nos. 2, 3, Feb. Mar., 1922, pp. 81-85, 185-188. Deals with fundamentals of contact with employees to stimulate production. Co-operation by managers and employees through works councils.

EXECUTIVES

FUNCTIONS AND METHODS OF CHIEF. A Technique for the Chief Executive, John H. Williams. Taylor Soc. Bul. vol. 7, no. 2, Apr. 1922, pp. 47-68. Notes on responsibilities and duties of chief executive and a method through which he might function effectively.

PROBLEM OF CHIEF. The Problem of the Chief Executive, Henry P. Kendall. Taylor Soc. Bul., vol. 7, no. 2, Apr. 1922, pp. 39-46. From point of view of medium-sized enterprise.

EXPLOSIVES

PLANT. A New Explosives Plant. Can. Min. Jl., vol. 43, no. 17, Apr. 28, 1922, pp. 252-254. Some details of Northern Explosives Ltd. at Dragon, Que.

F

FEEDWATER HEATERS

LOCOMOTIVE. Locomotive Feed Water Heaters, H. B. Oatley. Southern and Southwestern Ry. Club, vol. 16, no. 7, Jan. 19, 1922, pp. 14-37 and (discussion) pp. 37-45, 19 figs. General discussion of development and prospects, with suggestions as to operation.

FIRE PREVENTION

AUTOMATIC DEVICES. Automatic Devices for Preventing Fires in Buildings (Dispositifs automatiques de protection des édifices contre l'incendie), Jacques Michaut. Génie Civil, vol. 80, no. 13, Apr. 1, 1922, pp. 295-299, 8 figs. Deals with sprinkler systems such as Grinnell type, automatic fire alarms, etc.

WATER SUPPLY, RELATION OF. Fire Service as it Relates to Water Supply, Dow R. Gwinn. Mun. and County Eng., vol. 62, no. 4, Apr. 1922, pp. 148-154. Several features of water problem in this field.

FLOW OF WATER

WEIRS. Experiments With Flow Over Weirs With End Contractions (Expériences sur des déservoirs à nappe libre avec contraction latérale.), V.-M. Hegly. Annales des Ponts et Chaussées, vol. 6, Nov.-Dec. 1921, pp. 290-389, 43 figs. Gives results of measurements of flow for triangular, semicircular, multiple, and other discharges in connection with Marne-Saône canal.

FOUNDRIES

CASTINGS, COST OF. System Keeps Tab on Foundry Costs, H. C. Keller. Foundry vol. 50, no. 8, Apr. 15, 1922, pp. 308-310 and 315, 9 figs. Outlines simplified method for finding costs of castings; suitable for small shops.

HANDLING PRODUCTS. Heavy Tonnage from a small Floor. Foundry, vol. 50, no. 8, Apr. 15, 1922, pp. 301-307, 10 figs. Discusses co-ordination of supply of materials and sequence of operation as essential to molding and pouring of castings.

HEATING UNITS, MANUFACTURE OF. Heater Sections Made in Quantity. Foundry, vol. 60, no. 7, Apr. 1, 1922, pp. 267-274, 12 figs. System of providing large and continuous vents in cores automatically removes most dangerous factor in producing castings of this character.

FUELS

AUTOMOBILE. *See automobile fuels.*

HOGGED. Hogged Fuel, Emery A. Morrison. Power Plant Eng., vol. 26, no. 8, Apr. 15, 1922, pp. 407-410, 4 figs. Its heat-producing value; design and adaptability of furnace; means and method of handling fuel to furnace grates. From paper read before Western Section of Am. Soc. Mech. Engrs.

LOW-GRADE. Contributions to the Improvement of German Fuel Economy (Beiträge zur Verbesserung der deutschen Brennstoffwirtschaft), Otto Brandt. Wärme (formerly Zeit. für Dampfkessel u. Maschinenbetrieb), vol. 45, nos. 4, 5 and 6, Jan. 27, Feb. 3, and 10, 1922, pp. 53-55, 68-71 and 81-83. Discusses use of peat, lignite and other low-grade fuels and design of furnaces for their use; distribution and efficient exploitation of high-grade fuels; utilization of German crude oil; water-power utilization, etc. Future prospects.

PRE-CARBONIZATION. Pre-carbonization of Fuels (La carbonisation préalable des combustibles). Outillage, vol. 253, no. 13, Apr. 1, 1922, pp. 377-380, 4 figs. Low-temperature carbonization; tar distillation; low-grade fuels, etc.

See also coal; gas, liquids; oil fuels; pulverized coal.

FURNACES, BOILER

OIL. New Oil Furnaces (Neue Oelfeuerungen), H. Pradel. Wärme (Zeit. für Dampfkessel u. Maschinbetrieb), vol. 45, no. 1, Jan. 6, 1922, pp. 10-12, 9 figs. Details of various types constructed by Körting Bros., Ind., near Hannover, Germany, including steam-jet centrifugal oil furnaces, low-pressure burners, etc.

FURNACES, FORGING

HEATING ARRANGEMENTS. The Need for Better Heating in Forging and Forming Practice. Forging and Heat Treating, vol. 8, no. 4, Apr. 1922, pp. 202-204, 2 figs. Typical arrangements of chambers and working openings in forging and heating furnaces to meet nature of process and material to be heated.

FURNACES, METALLURGICAL

GAS FIRING. Modern Gas Firing (Neuzeitliche Gasfeuerungen), M. Schimpf. Glückauf, vol. 58, no. 15, Apr. 15, 1922, pp. 424-428, 5 figs. Discusses question of using surplus gas in mining districts, and describes experiments with Lackworth and Rodberg burners for burning [illegible] gas.

OIL-FIRING. Oil Firing of Open-hearth Furnaces in Steel Foundries (Le Chauffage à l'Huile des Fours Martin), P. Jolly. Fonderie Moderne, no. 3, Mar. 1922, pp. 78-79. Discusses advantages of oil, such as absence of sulphur, regulation of temperature, intermittent operation, etc.

TEMPERATURE CALCULATION. Calculation of Working Temperatures in Metallurgical Furnaces (Errechnung der Arbeitstemperaturen in metallurgischen Öfen), Hugo Bansen. Stahl u. Eisen, vol. 42, nos. 7, 8, 10 and 11, Feb. 16, 23, Mar. 9 and 16, 1922, pp. 245-253, 291-297, 370-375 and 423-426, 17 figs. Notes on drop in temperature as calculated and actually reached; pyrometric evaluation of fuels; dynamic conditions for flame formation; required workpiece temperatures; temperature pressure between workpiece and flame; heat transmission. Determination of most suitable fuel.

FURNACES, OPEN-HEARTH

REGENERATIVE. Control of Heat Economy in Regenerative Furnaces (Ueberwachung der Wärmewirtschaft bei Regenerativefeuerungen), H. Berger. Wärme (Zeit. für Dampfkessel u. Maschinenbetrieb), vol. 45, no. 1, Jan. 6, 1922, pp. 12-14. Includes heat balance of regenerative furnace and auxiliary generator. Notes on sources and prevention of losses.

G

GAS

B.T.U. CALCULATION. New Graphic B.t.u. Calculator, Minor C. K. Jones. Gas Age-Rec., vol. 49, no. 13, Apr. 1, 1922, pp. 392-394, 1 fig. Discusses use of chart for calculation of heating value in B.t.u. per cubic foot of a gas, by which lengthy and laborious calculations are avoided.

SUSPENDED IMPURITIES, DETERMINATION OF. Determination of Suspended Impurities in Gases, Wilfred W. Scott. Jl. of Indus. and Eng. Chem., vol. 14, no. 5, May 1922, pp. 432-433, 4 figs. Beam test; determination of solid and liquid impurities; sulphuric acid mist in gas, arsenic in gas; deternination of chlorine.

FUEL, FUTURE USE. Gas—the Fuel of the Future, Thomson King. Am. Gas Jl., vol., 116, no. 14, Apr. 8, 1922, pp. 321-322 and 332-335. Deals with near future which can be plainly discerned and more distant future which must be dealt with in more general terms.

GAS MANUFACTURE

LIQUID PURIFICATION. Liquid Purification of Coal Gas, F. W. Sperr Gas World, vol. 76, no. 1970, Apr. 22, 1922, pp. 334-336, 5 figs. Removal of sulphuretted hydrogen by sodium carbonate. From Am. Gas Assn. Monthly.

PROPER UTILIZATION. Proper Utilization of Gas Important, Andrew M. Rowley. Oil and Gas Jl., vol. 20, no. 48, Apr. 27, 1922, p. 12, 1 fig. Domestic consumers waste 150 billion ft. annually, hastening depletion of supply and bringing closer day of costly substitutes.

RELATIVE USEFULNESS OF. Relative Usefulness of Gases, Floyd W. Parsons. Gas Age-Rec., vol. 49, no. 16, Apr. 22, 1922, pp. 483-484, 506. Results of investigation of different gases by U.S. Bur. of Standards. Proper burning conditions of air to gas and most economic heating value standards for gas.

GAS PRODUCERS

OUTSIDE. Outside Producers at Racine, H. R. Broker. Am. Gas. Jl., vol. 116, no. 14, Apr. 8, 1922, pp. 325-328, 4 figs. Notes on installation of producer plant consisting of two high-pressure producers which can easily at least one-half braize and one-half small or nut coke, and each of which is rated to gasify 25 tons of fuel per day. Saving effected in labor and fuel.

REINFORCED-CONCRETE. Reinforced Concrete Gas Producer. Engineer, vol. 133, no. 3457, Mar. 31, 1922, p. 364, 2 figs. Experimental producer built in Italy in accordance with patents of O. R. Verity. It is claimed that reinforced-concrete construction allows of economy in first cost of over 50 per cent, as compared with metal construction, and there is also economy in maintenance.

SOFT COAL BENCH FIRING. Soft Coal Producer Bench Firing, P. Gartner. Gas Age-Rec., vol. 49, no. 18, May 6, 1922, pp. 563-564, 1 fig. Describes a Bröcker bench installation and devices originated in operating it. From Monthly Bul. of Swiss Assn. of Gas and Water Engrs.

TRANSFORMING SOLID FUEL INTO GAS, FOR. Gas Generator Fusing Ash Type (Le gazogène à fusion des cendres), A. Fichet. Mémoires et Compte-Rendu des Travaux de la Société des Ingénieurs Civils de France, vol. 74, no. 10-12, Oct. Dec. 1921. pp. 595-638, 8 figs. Development of Ebelmen gas producer for transforming solid fuel into gas and using this in metallurgical furnaces.

TYPES. Gas Producers (Les Gazogènes), Louis Garand. Chaleur et Industrie, vol. 3, no. 24, Apr. 1922, pp. 1187-1192, 3 figs. Reviews development and describes most recent types made in France.

GAS TURBINES

THYSSEN-HOLZWARTH OIL AND. Thyssen-Holzwarth Oil and Gas Turbines, W. Schule. Motorship, vol. 7, no. 5, May 1922, pp. 351-355, 9 figs. Describes unique internal-combustion engine invented by Hans Holzwarth, and gives results of tests. (Extract.) Translated from German.

GASES

COMBUSTION OF MIXTURES. The Combustion of Complex Gaseous Mixtures. William Payman and Richard Vernon Wheeler. Chem. Soc. Jl., vol. 121-122, no. 713, Mar. 1922, pp. 363-379. Concludes that during propagation of flmae in mixture of several inflammable gases with air at given speed, gas which will monopolize most oxygen in that which when burning alone with same speed of flame is associated with most air.

GASOLINE

SUBSTITUTES. Gasoline Substitutes and Synthetic Products, Ernest Owen. Oil Trade Jl., vol. 13, no. 4, Apr. 1922, pp. 13-14 and 92. Development of cracking processes; methods designed to conserve fuel; using catalysts; oil shale projects, and principal shale sources; alcohol a promising source.

GEAR CUTTING

COMMERCIAL. Commercial Gear-Cutting Practice. Machy. (Lond.), vol. 20, no. 500, Apr. 27, 1922, pp. 109-112, 6 figs. Describes automatic spur gear cutter by John Holroyd & Co., Ltd.

COMMERCIAL PRACTICE. Commercial Gear-Cutting Practice. Machy. (Lond.), vol. 20, no. 498, Apr. 13, 1922, pp. 33-36, 20 figs. Spur gear-cutting machines of rotary-cutter type.

MULTIPLE SHAPERS. Stevenson Multiple Gear Shaper. Machy. (Lond.), vol. 19, no. 496, Mar. 30, 1922, pp. 791-793, 5 figs. Describe new 6-A down-stroke model.

GEAR DRIVE

NODAL ARRANGEMENTS OF. Nodal Arrangements of Geared Drives, J. H. Smith. Shipbldg. and Shipg. Rec., vol. 19, no. 15, Apr. 13, 1922, pp. 455-456. Illustration of violent effects of faulty arrangement on teeth of gear wheels.

GEARS

HYDRAULIC-POWER TRANSMISSION. Hydraulic Power Trapsmission Gears, M. H. Sabine. Practical Engr., vol. 65, nos. 1828, 1831, 1832 and 1833, Mar. 9, 30 Apr. 6, and 13, 1922, pp. 151-154, 205-206, 221-222 and 235-236, 8 figs. Mar. 9: Discusses variable power transmission by oil in which a prime mover revolving in one direction at constant speed is coupled direct to a variable delivery pump which delivers oil to a fluid motor, usually of fixed capcity. Mar. 30: Working of gear and features of Carey pump. Apr. 6 and 13: Carey pump cylinder action; pulsations and vibration: success of Hele-Shaw gear.

INVOLUTE. The Involute Gear Tooth—XII, A. Fisher. Machy. (Lond.), vol. 20, no. 498, Apr. 13, 1922, pp. 55-58, 8 figs. Generation by pinions.

LATEST PRACTICE. Gear Makers' Convention of Much Technical Interest, P. M. Heldt. Automotive Industries, vol. 46, no. 17, Apr. 27, 1922, pp. 901-906, 5 figs. Papers presented on good hob practice, use of projection comparator in testing gear teeth, proportion of industrial gears, the grinding of gear teeth and new system of bevel gears.

ONE-TOOTH PINION. A NoVel One-Tooth Pinion. Eng. Production, vol. 4, no. 82, Apr. 27, 1922, p. 396, 4 figs. Details of an interesting high-ratio gear.

TEETH REPAIRING. Repairing Broken Gear Wheel Teeth, G. H. Radebaufh. Brick and Clay Rec., vol. 60, no. 8, Apr. 18, 1922, pp. 617-620, 14 figs. Various styles of gears, four methods of repairing cast teeth, description of stud method which does not require commercial repair shop.

WORM-REDUCTION. Worm Reduction and Change speed Gearing. Engineer, vol. 133, no. 3457, Mar. 31, 1922, pp. 352-354, 4 figs. Describes new invention the novelty of which consists of entire absence of usual spur wheels and use instead of worms and worm wheels.

GIRDERS

TRANSVERSE VIBRATIONS OF BAR-SHAPED. The Bending Vibrations of Bar-Shaped Girders (Ueber Biegungsschwingungen stabförmiger Träger), W. Kauffman. Zeit. für angewandte Mathematik u. Mechanik, vol. 2, no. 1, Feb. 1922, pp. 34-35, 8 figs. Calculation of bending or transversal vibrations.

GRAVEL

COLUMBUS, OHIO. Producing Gravel with Few Men, Stephen Stepanian. Rock Products, vol. 25, no. 8, Apr. 22, 1922, pp. 31-35, 23 figs. Method of accomplishing larged production with small labour.

GYROSCOPES

VECTOR REPRESENTATION OF PROCESSION. A New Gyroscosic Construction in Simple Vectors, Will C. Baker. Physical Rev., vol. 19, no. 4, Apr. 1922, pp. 323-328, 4 figs. Means of deriving graphically the quadratic for steady precession and variation of same at constant angle with change of applied couple.

H

HANDLING MATERIALS

ELECTRICAL PLANTS. ModernElectrical Handling Plant, H. R. Broughton. Beama, vol. 10, nos. 3 and 4, Mar. and Apr. 1922, pp. 210-216, 8 figs. pp. 325-332, 4 figs. Mar.: Gives examples of various types of cranes and bridges transporters and discusses grain handling. Apr.: Canadian and South African grain handling installations. Data on use of grabs to increase unloading of ore into Great Britain. Buying cargo cranes.

WAGON TIPPING IN FACTORY YARDS. Modern Appliances for Tipping Wagons in Factory Yards. E. Krahnen. Eng. Process, vol. 3, no. 5, May 1922, pp. 111-113, 6 figs. Electrically operated tippers with toothed segments or traction ropes; double-end tippers; swinging tippers.

HEAT

ECONOMICAL USE. Economical Use of Heat (Sparsame Temperaturwirtschaft), K. Schreber. Dinglers Polytechnisches Journal, vol. 337, nos. 6 and 7, Mar. 25 and Apr. 8, 1922, pp. 51-54 and 61-65, 4 figs. Discusses relation of value of unit of work and value of unit of heat, and gives various illustrations of boilers.

CONSERVATION. Control of Heat Consumption (Ergebnisse der wärmetechnischen Betriebsüberwachung), H. Berner. Wärme (Zeit. für Dampfkessel u. Maschinenbetriebe), vol. 45, nos. 1 and 2, Jan. 6 and 13, 1922, pp. 6-9 and 30. Fundamentals of control; operating tests; measuring devices; loss and utilization of waste heat; the heat pump; waste energy; furnace and other losses; savings effected through control.

HEAT TRANSMISSION

BUILDING MATERIALS. Temperature Study in a Wall of Undefined Thickness Whose Faces are Subject to a Uniform Periodical Variation of Temperature (Etude du Régime des températures dans l'épaisseur d'un mur indéfini dont les deux faces sont soumises à une même variation périodique de la température), J. Seigle. Revue de l'Industrie Minérale, no. 30, Mar. 15, 1922, pp. 135-145, 11 figs. Mathematical paper on heat transmission and heat conductivity of materials such as brick.

HEAT TREATING

GAS FIRING. Gas Wins Out for Heat Treating, J. P. Lafore. Gas Age-Rec., vol. 49, no. 15, Apr. 15, 1922, pp. 451-452 and 456, 3 figs. Describes gas equipment of eastern metallurgical plant which was installed after considerable experience with coal, electricity, óil and gas.

MEDIUMS. Fuels, Burners, and Quenching Mediums for Heat-treatment, S. P. Rockwell. Machy. (Lond.), vol. 20, no. 500, Apr. 27, 1922, pp. 100-103, 3 figs. Advantages and disadvantages of different kinds of fuel, types of burners, and description of results obtained by various quenching baths.

HEATING

Flue-Gas Utilization for. The Heating of Factory Rooms and Halls Through Utilization of Flue Gas (Neuzeitliche Grossraumheizung mittels Raunchgasausnutzung), Otto Brandt. Wärme (Zeit, für Dampfkessel u. Maschinenbetrieb), vol. 45, no. 1, Jan. 6, 1922, pp. 4-6, 6 figs. Describes two systems and points out their advantages and economy.

HEATING AND VENTILATING

Fan Furnace System. Fan Furnace Heating of a Theatre. Sheet Metal Worker, vol. 13, no. 6, Apr. 14, 1922, pp. 171-173, 5 figs. Describes heating and ventilating system of Rialto Moving Picture Theatre, Hamilton, Ohio, in which vertical sectional furnaces are used as air heaters, and fan is used to insure positive distribution and proper ventilation.

Leader, Sizes, Figuring. Simplified Scientific Method of Figuring Leader Sizes, P. J. Dougherty. Sheet Metal Worker, vol. 13, no. 7, Apr. 28, 1922, pp. 209, 215. Two rules by which to determine heat losses from building as well as leader pipe sizes.

HEATING, ELECTRIC

Losses. The Determination of Heat Loss, Walter W. Nobbs. Beama, vol. 10, no. 4, Apr. 1922, pp. 312-320, 2 figs. Fallacies in past heating determination in the formulas in coefficients and tables. Heating computations.

Residences, Tacoma, Wash. Electric Heating of Residences in Tacoma. Heat. and Vent. Mag., vol. 19, no. 4, Apr. 1922, pp. 41-45, 6 figs. Interesting features of installations in 795 residences, 54 apartments and 76 business and other buildings.

HEATING, STEAM

Central Stations. The Neukoelln Municipal Central Station for Distance Heating. Eng. Process, vol. 2, no. 4, Apr. 1922, pp. 77-78, 2 figs. At present 14 individual buildings or groups of buildings in a Berlin suburb are supplied with heat from this common source. Heating plant was designed and executed by Körting Bros., Berlin Branch. Required heat supply amounts to 5,800,000 kg. cal. per hr., and it is intended to enlarge station to max. heat output of 15,000,000 kg. cal. per hr.

HIGHWAYS

Transportation Economics. Traffic Facts Shown by Highway Transportation Surveys. Automotive Industries, vol. 46, no. 17, Apr. 27, 1922, pp. 917-919, 1 fig. Overloading is prevalent in hauling all commodities. Trucks handle large percentage of manufactured products carried over route covered by surveys; 3.2 passengers per car is average determined; 2-ton trucks form 16 per cent of total. Census example of needed transport studies.

Research. Highway Research and What the Results Indicate, A. T. Goldbeck. Good Roads, vol. 62, no. 16 and 17, April 19 and 26, pp. 223-226, 228-230 and 233-238, 19 figs. Technical consideration of loads, impact and moisture.

Soil Moisture. The Effect of Soil Moisture on Highway Design, J. L. Harrison. Mun. & County Eng., vol. 62, no. 4, Apr. 1922, pp. 123-125. Consideration of moisture of difference kinds and best treatment in view of same.

HYDRAULIC MACHINERY

Engines. A New Hydraulic Engine (Eineneue Wasserkraftmaschine "Aquapulsor"), E. Winkel-Glasers Annalen, vol. 90, no. 6, Mar. 15, 1922, pp. 92-97, 21 figs. Describes new type known as aquapulsor, and its use for irrigation and drainage, and for filling and emptying of navigation locks.

HYDRAULIC TURBINES

Large Installations. Some Large Turbine Installations in Austria and Other Countries (Einige grössere Turbinenanlagen in Oesterreich und im Ausland), W. Hahn. Elektrotechnik u. Maschinenbau, vol. 40, nos. 12 and 13, Mar. 19 and 26, 1922, pp. 133-139 and 147-149, 12 figs. History of development and examples of large turbine installations in America, Scandinavia, Japan, Germany, etc.

Molding 50-Ton Runner. Molding a 50-Ton Turbine Runner. Foundry, vol. 50, no. 8, Apr. 15, 1922, pp. 318-321, 6 figs. Set of cores forming mold was assembled on an iron plate divided in two for convenience in setting last of vane cores.

HYDRODYNAMICS

Equations. Ambiguous Solutions of the Hydrodynamic Equations (Ueber Mehrdeutige Losungen der hydrodynamischen Gleichungen), George Jaffé. Physikalische Zeit., vol. 23, no. 6, Mar. 15, 1922, pp. 129-133, 4 figs. Presents example, similar to Villat example, of two-directional flow against a hollow space, thus forming a dead-water area of indeterminate size in the space.

HYDROELECTRIC DEVELOPMENTS

Belgium. Utilization of Belgian Hydroelectric Resources (Avant-Projet de captation des énergies hydrauliques Belges), Herman Chauvin. Revue Universelle des Mines, vol. 11, nos. 1, 3, 4, 5, 6, Oct. 1, Nov. 1, 15, Dec. 1, 15, 1921, pp. 1-28, 261-277, 509-523, 629-644, 15 figs. on supp. plates. Oct. 1: Discusses general questions of river water supply and control for power purposes; and barrage work carried out in various rivers. Nov. 1, 15, Dec. 1 and 15: Describe work carried out on the Sambre and Meuse rivers.

Chippawa-Queenston. First 50,000 hp. Unit of Chippawa-Queenston Power Scheme. Elec. News, vol. 31, nos. 4, 5, 6, 7 and 9, Feb. 15, Mar. 1, 15, Apr. 1 and May 1, 1922, pp. 29-34, 28-33, 30-34, 27-34 and 32-35, 35 figs. Feb. 15: Series of articles describing work in connection with location of intake, canal and power house; also general design. Mar. 1: Details of hydraulic installation. Mar. 15: Excavation methods for moving 17,000,000 cubic yards of material and cutting through rock and earth; lining of canal; etc. Apr. 1: Design of power plant and specifications and installation of major apparatus May 1: Description of generators nos. 4 and 5 being completed by Can. Gen. [illegible]

I

ICE MANUFACTURE

Raw Water Can System. Modern Systems for Manufacture of Raw Water Can [illegible] Ice and Refrigeration, vol. 62, no. 4, Apr. 1922, pp. 287-288. Some details of method of obtaining clear ice by means [illegible]

ICE PLANTS

Electrically Operated. The Electrically Operated Ice Plant, H. J. Macintire. Ice and Refrigeration, vol. 62, no. 4, Apr. 1922, pp. 273-277. Some results of advance in use of electricity in last five years.

INDICATORS

Planimetric. Planimetric Indicator (Planiketrierender Indikator), L. Gümbei. Zeit. des Vereines deutscher Ingenieure, vol. 66, no. 13, Apr. 1, 1922, pp. 298-299, 6 figs. Describes indicator developed by author, consisting of an indicator cylinder of usual dimensions with outside spring and without writing device. The gear is so arranged that the indicator records progressively.

INDUSTRIAL MANAGEMENT

Antagonism. The Inevitable Antagonism Between Employers and Employees Management Eng., vol. 2, nos. 4 and 5, Apr. and May 1922, pp. 246-247, 308-309. Discussion by various authors of article by C. E. Knoeppel in March issue.

Charting, Authority and Responsibility. Charting Authority and Responsibility to Show Complex Management Relationships, Boyd Fisher. Management Eng., vol. 2, no. 5, May 1922, pp. 281-284, 2 figs. Lack of value of familiar organization charts and suggestions for an samples of worthwhile ones.

Cost Control Committee. The Organization and Operation of the Cost Control Committee Plan, John H. Van Deventer. Indus. Management, vol. 63, no. 5, May 1922, pp. 267-272. Machinery of plant for building economic morale to re-establish profit margins.

Cost Predetermination. The Determination of Costs, J. McD. Cronin. Indus. Management, vol. 63, no. 4, Apr. 1922, pp. 221-224. A system which will reveal true costs in time to control them.

Executive Ability. Measuring Executive Ability, William E. Dunn. Indus. Management, vol. 63, no. 5, May 1922, pp. 292-295. Suggesting measure of value and deducing factors that compose it.

Foremen, Training. Foremen Training as a Factor in Cost Reduction, B. M. Nussbaum. Indus. Management, vol. 63, nos. 4 and 5, Apr. 1922, pp. 229-233, 297-302. Apr.: Analysis of lecture-class method, conference-discussion method and standard-group study course, and advantages and disadvantages of each. Means of getting and holding the foremen's interest.

Production Cost Cutting. Cutting Production Costs by Combining Manufacturing Operations, C. B. Bartlett. Indus. Management, vol. 63, no. 4, Apr. 1922, pp. 198-200, 2 figs. Operations which can be combined, substantially decreasing costs as well as reducing hazards.

Profits, Re-Establishing for Small Factory. Re-Establishing the Profits of the Small Factory, Ernest Cordeal. Indus. Management, vol. 63, no. 4, Apr. 1922, pp. 251-254. Importance of vesting authority to hire and discharge employees in special department.

University Training in Factory. Taking University Training to the Factory, Paul M. Atkins. Indus. Management, vol. 63, no. 4, Apr. 1922, pp. 239-242, 1 fig. Plan to increase receptivity of working force to new ideas, train employees for advancement and discover those best fitted for promotion.

Wastes. Searching Out the Invisible Wastes, C. J. Morrison. Indus. Management, vol. 63, no. 4, Apr. 1922, pp. 196-197. Some prominent points of attack for cost cutting campaign.

See also Executive; Safety Engineering; Time Study; Waste.

INDUSTRIAL TRUCKS

Electric. Electric Vehicles. Gen. Elec. Rev., vol. 25, no. 4, Apr. 1922, pp. 200-259, 62 figs. Special issue containing articles by various authors on the battery vehicle in England; electric trucks in express service and in automotive field; electric passenger vehicle; operation; design and application of motors; controllers and resistances for storage-battery-driven vehicles; charging systems; advantages of gasoline and electric trucks with interchangeable parts; etc.

INSPECTION

Methods. Inspection Methods that have Proved Successful, H. Alton. Can. Machy., vol. 27, no. 17, Apr. 27, 1922, pp. 17-19 and 21. See that specifications are correct. Incoming material should be carefully inspected before going into stores. Where gaging is most effective. Co-operation of departments.

INSULATION, HEAT

Thermoconductivity of. Heat Insulators. Refrig. World, vol. 57, no. 4, Apr. 1922, pp. 21-22. Abstract of special report of Food Investigation Board of G. B. on thermal conductivity of insulating materials usually employed.

INSULATORS, ELECTRIC

Suspension. Practical Safety Factors for Suspension Insulators of Various Types (Quelques coefficients de sécurité pratiques au sujet des isolateurs suspendus de différents modèles), Paul Testard. Revue Générale de l'Électricité, vol. 11, no. 11, Mar. 18, 1922, pp. 393-398, 4 figs. How to choose an insulator; mechanical resistance of porcelain; explains safety factor in various insulators.

INTERNAL-COMBUSTION ENGINES

Alcohol for Fuel. Alcohol for Motor Fuel. Soc. Automotive Engrs. Jl., vol. 10, no. 5, May 1922, pp. 364-365. Possibilities of more general use and points in favour of and against it.

Combustion Process. Combustion Process in Explosion Engines (Forbraendingsprosesser i eksplosjonsmotorer), W. Holwech. Teknisk Ukeblad, vol. 69, nos. 9, 10 and 12, Mar. 3, 10 and 24, 1922, pp. 78-80, 87-91 and 116-118, 12 figs. Mar. 3: Mixing of gases; compression; ignition; combustion; expansion Mar. 10: Discusses velocity of propagation of combustion, limits of explosions and gives curves for various combustibles, such as methane, ethane, water-gas, acetylene, etc. Mar. 24: Discusses results of new investigation, including heat of combustion and heat balance.

Design. Modern Tendencies in Internal-Combustion Engine Construction (Tendances modernes dans l'étude et la construction des moteurs), Edmond Bruet Outillage, Tomes 251, 252 and 253, nos. 11, 12 and 13, Mar. 18, 25 and Apr. 1 1922, pp. 326-328, 353-356 and 374-377, 23 figs. Mar. 18: Combustion of gaseous mixtures; propagation of flame. Mar. 25: Korosene, in internal-combustion engines (Bellem and other engines). Apr. 1: Deals with Diesel Engines. Construction and operation of Sulzer two-stroke engine, the Ruston hig-pressure engine, and compound Diesel engine.

Friction Losses. Friction Losses in Internal-Combustion Engines (Étude des pertes par frottement dans les moteurs à combustion interne), André Planiol Comptes Rendus des Séances de l'Académie des Sciences, vol. 174, no. 13

Mar. 27, 1922, pp. 560-563. Gives results of experiments with four-stroke single-cylinder engine running on town [illegible] graphs for [illegible]

Fuel-Introduction Systems. Fuel Introduction Systems for Internal Combustion Engines. Pacific Mar. Rev., vol. 19, no. [illegible] May 1922, pp. 285-286, 9 figs. Description of high pressure system developed for use with engines using accumulated type of fuel injection.

Research. Recent Research Work on the Internal Combustion Engine, Harry R. Ricardo. Soc. Automotive Engrs. Jl., vol. 10, no. 5, May 1922, pp. 305-328 and discussion 328-336 and 347, 12 figs. [illegible] of fuel [illegible] to [illegible] volatility, detonation, turbulence, stratification, and comment on benefits of weak fuel mixtures.

Still System. The Still System of Internal Combustion, J. Leigh Martineau. Can. Shipg. & Mar. Eng. News, vol. 12, no. 4, Apr. 1922, pp. 17-19. Shows that Still system can be applied to any type of internal-combustion engine without any radical alteration. Mechanical features are dealt with.

See also Automobile Engines, Diesel Engines, Marine Engines, Semi-Diesel Engines.

IRON AND STEEL

Gases in. Determination of Gases in Iron and Steel (Bestimmung der Gase in Eisen und Stahl), A. Vita and Eduard Maurer. Stahl u. Eisen, vol. 42, no. 12, Mar. 23, 1922, pp. 445-452 and discussion, pp. 452-456, 3 figs. Two reports from Chemical Committee of Assn. German Iron Met. Engrs. on process for determination of gases by means of chemical changes; and comparison of results with those obtained in extraction process by physical means.

Properties and Uses. Iron and Steel Classified for Designers, Wm. J. Merten. Blast Furnace & Steel Plant, vol. 10, no. 4, Apr. 1922, pp. 230-234, 12 figs. Survey of wrought iron, malleable iron, cast iron, and semi-steel, with special reference to physical properties, characteristics, uses and heat treatment.

IRON CASTINGS

Engines. Engine Castings Requirements Rigid, H. J. Young. Foundry, vol. 50, no. 8, Apr. 15, 1922, pp. 311-314, 18 figs. Micrographs show variation in iron in same castings; heat tends to cause Diesel-engine cylinder liners and pistons to grow; study of requirements urged. (Abstract.) Paper read before Inst. Mar. Engrs.

Liquid Fracture in. Liquid Fracture in Iron Castings, S. C. Smith. Foundry Trade Jl., vol. 25, no. 296, Apr. 20, 1922, pp. 283-285, 7 figs. An occurrence which takes place in a casting before whole of casting has become solidified, sometimes being only microscopic and sometimes so large that it separates casting in two pieces.

IRON, PIG

Casting Methods. Questions Pig Iron Casting Methods, Robert E. Newcomb. Foundry, vol. 50, no. 8, Apr. 15, 1922, pp. 316-317. Advantages and disadvantages for foundry use of sand-cast pig iron, compared with those of pig iron made by machine casting process.

L

LAPPING

Hand and Machine. Hand and Machine-lapped Surfaces as seen through a Microscope. Machy. (Lond.), vol. 20, no. 500, Apr. 27, 1922, pp. 113-114, 6 figs. Comparison of two types of finish magnified 220 times.

LIGHTHOUSES

Aerial. Powerful Lighthouses in Aerial Navigation (Les phares à grande portée en navigation aérienne), A. Volmerange. Aéronautique, vol. 4, no. 34, Mar. 1922, pp. 67-74, 7 figs. Development of marine lights and lenses; principles of new powerful aerial lights, such as Barbier-Bénard and Sautter-Harlevisibility of light; etc.

LIGNITE

Burning on Chain Grates. Burning Canadian Lignite on Chain Grates. Power House, vol. 15, no. 8, Apr. 20, 1922, pp. 27-28, 2 figs. Mention of several installation of Saskatchewan and Manitoba districts in which satisfactory results have been obtained. Describes typical furnace arrangement.

Deposits and Industries. Lignites and Brown Coals and Their Importance to the Empire, William Arthur Bone. Royal Soc. Arts Jl., vol. 70, no. 3619, Mar. 31, 1922, pp. 342-355 and (discussion) 355-359, 1 fig. Origin and classification, characteristics and properties; geographical distribution; brown-coal industries in various countries.

Drying. Drying of Brown Coal for Boilers and Furnaces (Rohbraunkohletrocknung für Dampfkesselfeuerungen und industrielle Oefen), W. Viebahn. Braunkohle, vol. 20, no. 51, Mar. 25, 1922, pp. 801-805, 1 fig. Discusses heat loss due to water content in brown coal and preheating of brown coal to deprive it of its water.

Gasification. Past Efforts and Future Prospects in Lignite Gasification for the Heating of Open-Hearth Furnaces (Die bisherigen Bestrebungen und die zukünftigen Aussichten der Braunkohlenvergasung für die Beheizung von Siemens-Martinöfen), Hubert Hermann. Braunkohle, vol. 20, nos. 22 and 23, Sept. 3 and 10, 1921, pp. 337-341 and 358-362, 8 figs. Economic and technical aspects of lignite gasification.

LOCOMOTIVE BOILERS

Design. Designing Locomotive Boilers for Maximum Efficiency, J. T. Anthony. Boiler Maker, vol. 22, no. 4, Apr. 1922, pp. 107-108. Air and gas areas and ratio of tube length to diameter important factors to be considered.

Standard for 2-8-0 Type. Standard Boiler for 2-8-0 Type Mixed Traffic Locomotives, Great Western Railway. Ry. Gaz., vol. 36, no. 14, Apr. 7, 1922, pp. 600-601, 3 figs. Has coupled wheels 5 ft. 8 in. in diam.; boiler is No. 7 Swinton type; barrel tapers from 6 ft. diam. outside at throat plate to 5 ft. 6 in. diam. outside at smokebox; length of barrel, 14 ft. 10 in.

Tubes. Installing and Maintaining Charcoal Iron Locomotive Tubes, G. H. Woodroffe and C. E. Lester. Boiler Maker, vol. 22, no. 4, Apr. 1922, pp. 102-106, 13 figs. Use of welding in tube work and proper methods to be followed in maintenance and repair.

LOCOMOTIVES

British and American Practice. British and American Locomotive Practice. Ry. Engr., vol. 43, no. 507, Apr. 1922, pp. 126-127. Abstract of paper presented at recent meeting of I.M.E. by P. C. Dewhurst, Loco., Carriage, and Wagon Supt. of Jamaica Govt. Rys. Closely reasoned comparisons and criticisms well worth considering.

Design. Modern Tendencies in Locomotive Design, James Partington. Ry. Age, vol. 71, no. 15, Apr. 15, 1922, pp. 909-910 (includes discussion). Need of increased economy in use and production of steam; possibility of turbine and internal-combustion locomotives. (Abstract.) Paper presented at Newport News meeting of Am. Soc. Mech. Engrs.

Gasoline. A Gasoline Locomotive (Une locomotive à essence), Ach. Delamarre. Outillage, vol. 252, no. 12, Mar. 25, 1922, pp. 359-360, 2 figs. Describes new Renault locomotive for shunting and similar purposes in factories.

Lentz Hydraulic Transmission. "Lentz" Hydraulic Transmission for Crude-Oil Locomotives, Wittfeld. Eng. Progress, vol. 3, no. 5, May 1922, pp. 105-108, 4 figs. Internal-combustion engine burning heavy crude oil is to be adapted for locomotive service by means of Lentz hydraulic transmission. First crude-oil locomotive on this system has just been put in commission. Results of trials with this locomotive.

Steam-Electric Condensing-Turbine. New Development in Locomotive Practice. Ry. Gaz., vol. 36, no. 13, Mar. 31, 1922, pp. 557 and 564, 4 figs. partly on p. 558. Describes Ramsay condensing-turbine electric locomotive, built by Armstrong, Whitworth & Co., Ltd., tractive force, 22,000 lb.

LUBRICATING OILS

Crankcase Oil Dilution. Crankcase Oil Dilution Problem and Its Solution, William F. Parish. Eng. World, vol. 20, no. 5, May 1922, pp. 307-314, 11 figs. Effect upon viscosity of lubricant; viscosity limits for lubricating oils established; relation between viscosity of lubricant and efficiency of engine shown graphically in tabular form. See also Oil News, vol. 10, no. 9, May 5, 1922, pp. 33-34 and 44-46, 1 fig.

Reconditioning Crankcase. Reconditioning Crankcase Lubricating Oil by a New Method. Automotive Industry, vol. 46, no. 17, Apr. 27, 1922, pp. 910-911, 3 figs. Fuel diluent and water automatically removed from crankcase lubricating oil by simple refiner which also filters out sediment.

LUBRICATION

Uniflow Engine. Lubrication of the Uniflow Engine. Power Plant Eng., vol. 26, no. 9, May 1, 1922, pp. 477-479. Some of features which make lubrication different for this type of engine and suggestions for proper solution. (Abstract.) Lubrication, pub. by Texas Co.

M

MACHINE SHOP

Field Shop. A Field Shop in the Oil District, Frank A. Stanley. Western Machy. World, vol. 13, no. 4, Apr. 1922, pp. 120-122, 8 figs. Description of well-equipped shops maintained in Signal Hill Oil fields by Shell Co.

MACHINE TOOLS

Chain Drive. The Chain Drive and Machine Tools, Hubert Bentley. Mech. World, vol. 71, nos. 1838 and 1839, Mar. 24 and 31, 1922, p. 215 and pp. 235-236, 3 figs. Mar. 24: Compares chain with belt and gear drives; advantages of chain drive. Mar. 31: Types of chains and wheels; chain driving and installation and maintenance of chain drives.

MAGNESIUM

Heat of Formation of Compounds. Heat of Formation of Compounds of Metallic Magnesium with Metallic Zinc, Cadimum, Aluminum and Calcium (Die Bildungswärmen der Verbindungen von metallischen Magnesium mit metallischem Zink, Cadmium, Aluminium und Calcium), Wilhelm Biltz and Georg Hogorst. Zeit. für amorganische und allgemeine Chemie, vol. 121, no. 1, Mar. 14, 1921, pp. 1-21, 2 figs. Determine heat of formation as difference of heats of solutions of metallic compounds and of individual metals in nitric acid; describes calorimeter used, metals and metallic compounds used, and results of measurements.

MALLEABLE IRON

Structure. Structure of White-Heart Malleable, Rudolph Stotz. Foundry, vol. 50, no. 7, Apr. 1, 1922, pp. 286-290, 25 figs. Principal characteristics shown by micrographs which indicate over or under annealing; carbon contents determine structure of unannealed iron.

MATCH MANUFACTURING

Moisture-Proof. Matches Unaffected by Humidity (Les allumettes inaltérables à l'humidité), R. Villers. Nature, no. 2494, Jan. 21, 1922, p. 43. New French matches "Naïdes" which contain bakelite as agglutinant, rendering them insensible to moisture.

MATTER

Molecules, Space between. The Space Between Molecules (Ueber den Abstand der Molekeln), Richard Gans. Physikalische Zeit., vol. 23, no. 5, Mar. 1, 1922, pp. 108-113, 4 figs. Derivation of equations for determining average space between molecules.

METALLURGY

Spectrographic Analysis. Spectrographic Analysis in Metallurgy (Sur l'emploi de l'analyse spectrographique en métallurgie), A. de Gramont. Revue de Métallurgie, vol. 19, no. 2, Feb. 1922, pp. 90-100, 9 figs. partly on supp. plates. Dissociation spectra in special steels; their preparation and application in identification of steels.

METAL SPRAYING

Schoop Process. Metal Spraying, An Anti-Rust Prophylactic. Raw Material, vol. 5, no. 4, May 1922, pp. 147-149, 4 figs. By Schoop process iron, steel, and non-metallic materials are given non-ferrous metal coatings through device resembling machine gun that bombards objective surface with minute plastic particles of metal.

METALS

Protection from Air and Heat. Protecting Metal From Air and Heat—Calorizing (La protection des métaux contre les agents atmosphériques et la chaleur—La calorisation ou protection par l'aluminium), R. Levatel. Outillage, vol. 254, no. 14, Apr. 8, 1922, pp. 412-413. Reviews the Bower-Barff, Gesner, Lohman, Schoop and sherardizing processes. Bibliography.

The Tempering Phenomena and Their Generalization (Les phénomènes de trempe et leur généralisation), De Perdiguier. Chimie et Industrie, vol. 7, no. 2, Feb. 1922, pp. 211-243, 32 figs. Discusses critical points in temperature diagrams, including the cases of, eutectoids, line of transformation, separating zone of one constituent from zone of two constituents, and zone of two constituents with two irregular lateral boundaries.

Tempering Phenomena and Their Generalization (Les phénomènes de trempe et leur généralisation), Léon Guillet. Revue de Métallurgie, vol. 19, no. 3, Mar. 1922, pp. 162-168, 13 figs. On basis of diagram discusses the three cases of (1) eutectoid, (2) line of transformation separating zone of one constituent from zone of two constituents, and (3) zone of two constituents bounded laterally by two irregular lines.

MICA

Uses in 1922. Properties and Uses of Micas. Beama, vol. 10, no. 4, Apr. 1922, pp. 321-324. Classification and identification tests and comparisons with other insulating materials. Report of the British Elec. and Allied Industries Research Assn.

MILLING MACHINES

Vertical, Economy of. Examples Where Vertical Milling Saved Money, J. H. Moore. Can. Machy., vol. 27, no. 16, Apr. 20, 1922, pp. 17-18, 46, 5 figs. Suitable fixtures facilitate production; multi-tooth cutters replace single point tool; particularly adapted to die-sinking; special attachments for continuous milling.

MINERAL INDUSTRY

Non-Metallic. Non-Metallic Mineral-Filler Industry of the South, W. M. Weigel. Cement, Mill & Quarry, vol. 20, no. 8, Apr. 20, 1922, pp. 37-39. Consideration of mica, talc, whiting, ocher, silica, slate flour; need for investigation; great opportunity for development of industry.

MINERALS

Nickel-Copper Deposits. The Shebandowan Nickel-Copper Deposits, J. G. Cross. Can. Min. Jl., vol. 43, no. 18, May 5, 1922, pp. 270-271. Interesting account of nickel, copper, cobalt, and an unidentified mineral carrying comparatively high values in precious metals, 70 miles west of Port Arthur, Ont.

MINING

Opencast or Stripping Method. Some observations on Mining by the Opencast or Stripping Method, R. E. Palmer. Queensland Govt. Min. Jl., vol. 23, no. 262, Mar. 1922, pp. 100-104, 10 figs. Paper submitted to Inst. of Min. & Metallurgy, pointing out advantages of this method where possible.

MOLDING MACHINES

Portable Hand-Operated. Exhibits a German Molding Machine. Foundry, vol. 50, no. 8, Apr. 15, 1922, pp. 324-325, 5 figs. Describes portable, hand-operated machine of Vereinigte Schmirgel & Maschinenfabriken, A. G., recently exhibited at Liege, Belgium.

MOLDING METHODS

Production. Fittings Made on Production Basis. Foundry, vol. 50, no. 9, May 1, 1922, pp. 359-365, 9 figs. Adoption of simple and precautionary molding devices in shape of lifting plates and core prints reduce molding costs and insure more uniform product.

MOLYBDENUM STEEL

Automotive Industry. Use of Molybdenum Steel in the Automotive Industry, John D. Cutter. Soc. Automotive Engrs. Jl., vol. 10, no. 5, May 1922, pp. 340-342 and (discussion) 342-344 and 347, 2 figs. Advantages in connection with light-weight car including reports and statements of metallurgists and manufacturers.

MONEL METAL

Properties and Uses. Monel Metal, a Natural Nonferrous Alloy, Morris A. Hall. Brass World, vol. 18, nos. 3 and 4, Mar. and Apr. 1922, pp. 76-79, 107-111, 18 figs. Appearance and properties; proper methods of melting and casting; uses and advantages.

MOTOR BUSES

Trolley. Some Details of the "Rail-less" Car. Bus Transportation, vol. 1, no. 5, May 1922, pp. 268-269, 5 figs. Two-motor trolley bus with series-parallel control, seating capacity is thirty persons, with provision for liberal space and conveniences for several standees.

Trolley Bus Line Material and Current Collectors, G. W. Bower. Bus Transportation, vol. 1, no. 5, May 1922, pp. 281-282, 6 figs. Result of experience shows that design of suspension and collectors must co-ordinate.

MOTOR TRUCKS

Gas Producers. The Cazes Gas Producer for Motor Trucks (Le gazogène "Cazes" pour camion automobile), E. Weiss. Nature, no. 2501, Mar. 11, 1922, pp. 145-147, 3 figs. Describes producer-gas generator of 30-40 hp. consuming [illegible] charcoal per hp. and pulling trucks of nearly 12 tons.

N

NATURAL GAS

[illegible] Tests. Natural Gas Combustion Tests, I. V. Brumbaugh and G. W. [illegible] vol. 49, no. 16, Apr. 22, 1922, pp. 495-498, 3 figs. [illegible] Asst. Chemist of U. S. Bur. of Standards give, with permission, advance information on their tests of natural gas used in domestic gas burners.

NAVAL ENGINEERING

[illegible] Waves. Shipbldg. & Shipg. Rec., vol. 19, no. 17, Apr. 27, 1922, pp. 547-548. Results of experiments carried out by Mr. [illegible] progress of ship models of various [illegible]

NICKEL ALLOYS

Cooperite. Cooperite, a High-Speed Cutting Material. Raw Material, vol. 5, no. 3, Apr. 1922, pp. 110-112, 4 figs. Discusses properties of and tests made with cooperite, a non-ferrous alloy containing nickel as basic metal with various amounts of zirconium, aluminum, silicon, tungsten and molybdenum.

Nickel-Silver. Some Mechanical Properties of the Nickel-Silvers, F. C. Thompson and Elwin Whitehead. Metal Industry (Lond.), vol. 20, nos. 11 and 12, Mar. 17 and 24, 1922, pp. 249-254 and pp. 276-277 and (discussion) p. 280, 17 figs. Effect of conditions of annealing on tensile properties of hard-rolled alloys; temperature of heating and rate of cooling of three alloys containing 10, 15 and 20 per cent of nickel; results of tests. Paper read before Inst. Metals.

NOTCHED-BAR TESTS

Investigation of. The Notched-Bar Test (Die unerforschte Kerbschlagprobe), R. Stribeck. Stahl u. Eisen, vol. 42, no. 11, Mar. 16, 1922, pp. 405-408, 1 fig. Desiderata for new development. Notched-bar test for testing of workshop material. Author advises precaution in judging materials tested in this manner. Suggestions for a new regulation.

O

OIL FUEL

Laundry Power Plant. Oil Burning in Laundry Power Plant, Charles L. Hubbard. Nat. Engr., vol. 26, no. 5, May 1922, pp. 192-196, 9 figs. Oil substituted for coal and shows decided advantages; equipment details.

Naphtha, Calorific Power of. Indirect Determination of Calorific Power of Naphtha as a Fuel (Determinazione indiretta del potere cal orifico della nafta per uso di combustibile), Giulio Morpurgo. Giornale di Chimica Industriale ed Applicata, vol. 4, no. 1, Jan. 1922, pp. 15-17. Discusses new method for analyzing liquid fues, which requires no complicated apparatus, and gives rational basis for evaluating naphtha.

Pools, Beds, or Streams. Pools or Beds, Streams of Oil? J. von Gal Scale. Petroleum Times, vol. 7, no. 172, Apr. 22, 1922, p. 560. Pointing out misleading character of term pool.

OIL INDUSTRY

Bergin Treatment. The Bergin Treatment of Mineral Oils and Coal, F. Bergin. Petroleum Times, vol. 7, no. 172, Apr. 22, 1922, p. 546. Description of process by which mineral oils and coal can be converted into benzine, motor spirit, and fuel oil. Presented at Assn. of German Chemists' recent meeting.

OILS

Specifications for Fats and. Oils, Fats, Lubricants, Candles, and Soaps. Abridgments of Specifications, Period 1909-15, Class 91, 1922, 151 pp. Patents for inventions.

OIL SHALES

Australian Industry. Australian Oil-Shale Industry Now in Commercial Operation, Douglas A. Fell. Nat. Petroleum News, vol. 14, no. 18, May 3, 1922, pp. 89-90, 93, 1 fig. Oil-shale a going industry in Scotland, France and Australia. Some details of Australian development.

Fractionating Retort. The Brown Fractionating Shale Oil Retort, Frank E. Shepard. Eng. World, vol. 20, no. 5, May 1922, p. 315. Retort developed by Index Shale Oil Co. of Denver which will treat 250 to 300 tons of oil shale rock in 24 hrs.

OPEN-HEARTH FURNACES

Operation. Efficient Arrangement of Open Hearth Labor, P. S. Young. Blast Furnace & Steel Plant, vol. 10, no. 4, Apr. 1922, pp. 215-219. Reduction of forces by better distribution of men and occupations in operating modern open-hearth shop.

Valves, Reversing. New Reversing Valves for Open Hearth Furnaces, Hubert Hermanns. Blast Furnace & Steel Plant, vol. 10, no. 4, Apr. 1922, pp. 228-229, 4 figs. Describes new bell valve, consisting of two parts which are separated by water-cooled partition wall.

ORE CONCENTRATION

Iron, Magnetic Log Washers. Magnetic Log Washers in Iron-Ore Concentration, H. D. Wade. Eng. & Min. Jl.-Press, vol. 113, no. 18, May 6, 1922, pp. 769-771, 7 figs. Development of satisfactory device for concentrating low-grade magnetic iron ores. Washers of rake type receive overflow from classifiers, and discharge is into machines of spiral type of Babbitt plant.

ORES

Locating Device. Ore Locating Device. Min. & Oil Bul., vol. 8, no. 4, Apr. 1922, pp. 201-202. Facts about electric device developed by Ariz. Bur. Mines.

ORE TREATMENT

New Developments, Rand. The New Developments in Ore Treatment on the Rand, G. A. and H. S. Denny. Min. Jl., vol. 136, nos. 4515, 4517, 4518 and 4519, Mar. 4, 18, 25 and Apr. 1, 1922, pp. 170-171, 206-207, 232-233 and p. 242, 1 fig. Discusses methods of mining and methods of calculating and expressing mining returns. Advantages and disadvantages of resuing or undermining system of working; tabular statement of companies' results of mining and milling large quantities of mixed reef and waste rock, showing return from clean reef.

OXY-ACETYLENE WELDING

Railway Shops, in. The Oxy-Acetylene Process in Railway Shops, F. S. Tinder. Car Foremen's Assn. of Chicago. Official Proc., vol. 17, no. 6, Mar. 1922, pp. 16-39 and (discussion) pp. 40-57, 2 figs. Notes on properties of acetylene and oxygen; development of process. Experience in welding on Virginian railway.

Safe Handling. Gas Welding and Cutting. Am. Gas Jl., vol. 116, no. 14, Apr. 8, 1922, pp. 328-330 and 336-338. Rules for safe handling of apparatus.

P

PAINTS

PROTECTION FOR WOOD. Paint Protection for Wood, Clarence R. Myers. Soc. Automotive Engrs. Jl., vol. 10, no. 5, May 1922, pp. 348-350, 2 figs. Report of investigation resulting from complete lack of paint in protection of wood against moisture.

PAPER MANUFACTURE

DEODORIZING DIGESTER BLOW. Removal of Odors from Digester Blow in Sulphate Mills, Gustaf F. Enderlein. Paper Mill, vol. 45, no. 16, Apr. 29, 1922, pp. 4, 1 fig. Suggestions as to means of avoiding polluting atmosphere by condensing odoriferous steam.

DEVELOPMENTS. Recent Developments in Paper-making, J. D. Nuttall. Paper, vol. 30, no. 6, Apr. 12, 1922, pp. 7-11 and 16. Forming sheet and felting fibers on high speed machines of great width. From Proc. Technical Section of Papermakers' Assn. Great Britain and Ireland.

PARAFFIN

WAX, COMPOSITION. The Composition of Paraffin Wax, Francis Francis. Chem. Soc. Jl., vol. 121-122, no. 713, Mar. 1922, pp. 496-513. Action of air and Oxygen on paraffin wax; products of air oxidation; products of oxidation with oxygen in presence of turpentine; classification of acids formed in oxidation process; unoxidized hydrocarbons; etc.

PATTERNS

FOUNDRY, DESIGN. Pattern Design Presents Problems, Joseph Horner. Foundry, vol. 50, nos. 7 and 8, Apr. 1 and 15, 1922, pp. 275-278 and 326-328, 25 figs. Apr. 1: Co-operation between heads of manufacturing enterprise will prevent annoying and costly mistakes. Apr. 15: Pattern construction costs from pattern-shop viewpoint and from foundry and machine-shop viewpoint.

PAVEMENTS

CONSTRUCTION, DEVELOPMENTS. Development in Pavement Construction, Charles M. Upham. Can. Engr., vol. 42, no. 17, Apr. 25, 1922, pp. 424-425. Improvements in detail including curing concrete base; treating gravel and sand-clay surfaces.

PAVEMENTS, BRICK

CONSTRUCTION. Developments in Methods of Constructing Brick Pavements, Arthur H. Blanchard. Good Roads, vol. 62, no. 18, May 3, 1922, pp. 257-259. Suggestions brought about by Nat. Paving Brick Mfrs. Assn. for development of simple and efficient method of construction.

PEAT

HYDRAULIC EXCAVATION, FINLAND. Hydraulic Excavation of Peat in Finland (Das Hydrotorfverfahren in Finnland). Rauch u. Staub, vol. 12, no. 6, Mar. 1922, pp. 50-53. Discusses production of peat for boiler firing by hydraulic excavation, and subsequent drying producing 80 tons of fuel per 24 hr. with 10 workmen.

PIPE

THREADING AND CUTTING MACHINE. The Landis Twelve-Inch Pipe Threading and Cutting Machine. Ry. & Locomotive Eng., vol. 35, no. 4, Apr. 1922, pp. 83-85, 6 figs. Length of machine is 11 ft., its extreme width, 5 ft. and it weighs 13,000 lb.; it has single-pulley drive, and variations in speed, which are eight in number, are obtained by means of speed box, located beneath main spindle.

PIPING

LOSSES, CALCULATION OF. Calculating Losses in Air and Steam Conduits According to New Research on the Coefficient of Resistance to Flow (Calcul des pertes de charge dans les conduites d'air, de vapeur et d'eau d'après de nouvelles recherches sur le coefficient de résistance à l'écoulement), V. Leveau. Revue Universelle des Mines, vol. 12, no. 4, Feb. 15, 1922, pp. 301-327, 10 fihs. partly on supp. plate. Reviews literature on subject, calculates pressure losses, classifies pipe by roughness, and gives examples of applying new formulas.

PIPE LINES

WOOD PULP DEPOSITS, CLEANING OF. A Simple Method of Cleaning Long Pipe Lines of Deposits Made by Wood Pulp, Howard L. Ropes. Paper Mill, vol. 45, no. 17, May 6, 1922, pp. 10 and 12. Description of wood stave wire bound pipe of Sherman Paper Co. and methods of keeping it clean.

PISTONS

ALUMINIUM ALLOYS FOR MOTOR. Some Experiences of Aluminium and Its Alloys for Motor Pistons. Metal Industry (Lond.), vol. 20, no. 14, Apr. 7, 1922, p. 321. Advantages obtained from pistons of this type and analyses of more suitable combinations.

CAST IRON, PRODUCTION. Methods Used in Specialized Production of Cast Iron Pistons, J. Edward Schipper. Automotive Industries, vol. 46, no. 17, Apr. 27, 1922, pp. 914-916, 6 figs. Some original processes. Foundry cores are machine-made. Description of aging process, machining and inspection methods. Claimed that pistons are held to tolerance of plus or minus 0.0005 in.

PLASTER

GYPSUM. Making Prepared Gypsum Plaster. Rock Products, vol. 25, no. 9, May 6, 1922, pp. 30-33, 9 figs. Describes compact, effective plant for manufacturing this product.

PLATES

DEFLECTION. The Deflection of Continuous Plates and the Rectangular Plate with Free Edges (Ueber die Biegung durchlaufender Platten und der rechteckigen Platte mit freien Rändern), A. Nádai. Zeit. für angewandte Mathematik u. Mechanik, vol. 2, no. 1, Feb. 1922, pp. 1-26, 24 figs. Calculations to determine singularities of plate deflection.

POLARIZATION

APPARATUS AND POLARIZED LIGHT. Polarized Light and Polarization Apparatus (Polarisiertes Licht und Polarisationsapparate), Hans Schulz. Zeit. für technische Physik, vol. 3, no. 2, 1922, pp. 49-57, 11 figs. Methods for generation of polarized light; apparatus for determination of rotation polarization; and for determination of accidental double refraction.

POWER FACTOR

ECONOMIC LOSSES DUE TO. Analysis of Economic Loss Due to Power Factor—Basic Meterable Factors, J. E. Doran, J. B. Hodtum and R. C. Fryer. Nat. Elec. Light Assc. Bul., vol. 9, no. 5, May 1922, pp. 311-320, 8 figs. Two forms of loss due to out-of-phase-current and potential and suggestions for adjusting changes to them.

POWER PLANTS

BRITISH PRACTICE. Notes on British Power Plant Practice, C. H. S. Tupholme. Power Plant Eng., vol. 26, no. 8, Apr. 15, 1922, pp. 416-418. Experiments with peat; discussion of methods of improving internal-combustion engine efficiency.

CONSTRUCTION, FAR EAST. Dredge and Power-Plant Construction in the Far East, P. R. Parker. Eng. & Min. J.-Press, vol. 113, no. 119, May 13, 1922, pp. 807-812, 7 figs. Equipment purchased in U. S., modeled on California gold practice, a success in dredging for steam tin in Malay states; difficulties of transportation and installation solved.

COST CUTTING IN INDUSTRIAL. Cost Cutting for Industrial Power Plants, David Moffat Myers. Indus. Management, vol. 63, nos. 3, 4 and 5, Mar. Apr. and, May 1922, pp. 140-142 and 170, 234-237, 304-309, 4 figs. Mar.: How to discover and correct boiler plant wastes. Apr.: Determining present results and possible improvements. May: Methods of improving performance.

FIVE PACIFIC COAST PROJECTS. Five Pacific Coast Water-Power Projects Licensed by Commission. Elec. World, vol. 79, no. 17, Apr. 29, 1922, p. 850. Plants at Kaweah River outside Sequoia Nat. Park, on San Joaquin River in Fresno and Madora Counties, on Snow Creek, Riverside County, at Delta, Cal., and on Clackamas River, Clackamas County, Oregon, to be developed.

INDUSTRIAL, LAYOUT FOR. Laying Out a Power and Heating System for an Industrial Plant, Chas. L. Hubbard, Southern Engr., vol. 37, no. 3, May, 1922, pp. 47-51, 7 figs. Piping layout from boiler to engine and pumps, heating system, supply and return, and fire protection.

OPERATION. Higher Steam Pressures or Pulverized Coal? Frederick A. Scheffler. Am. Inst. Elec. Engrs. Jl., vol. 41, no. 5, May 1922, pp. 346-350, 1 fig. Assumes a hypothetical power or public service steam plant of 100,000-kw. nominal capacity and compares cost of operation of such a plant on basis of 250 lb. pressure and 600 deg. fahr. total steam temperature, and 400 lb. pressure and 700 deg. fahr. total steam temperature, when fired by stokers and pulverized coal.

STATION WIRING, FIREPROOFING. Station Wiring Adequately Protected by Fireproofing Liquid, S. C. Lindsay. Elec. World, vol. 79, no. 17, Apr. 29, 1922, pp. 835, 2 figs. Report of series of tests made by Puget Sound Power and Light Co. on number of sample cables to which a fireproofing had been applied.

UTICA STATE HOSPITAL. Power and Heating Plant of Utica State Hospital. Power Plant Eng., vol. 26, no. 9, May 1, 1922, pp. 449-456, 12 figs. Description of central installation to supply heat, light, water, and power for institution approaching proportions of a city.

POWER TRANSMISSION

OIL. Power Transmission by Oil (Elaulic Gear), H. S. Hele-Shaw. Oil Eng. & Finance, vol. 1, no. 1, Jan. 14, 1922, pp. 59-68, 16 figs. Description of oil-variable-gear which is newest of special type.

ROPE DRIVE. Power Transmission by Rope Drive, A. D. Welkinson. Southern Engr., vol. 37, no. 3, May 1922, pp. 35-37, 5 figs. Many textile mills are driven by means of rope-drive system. Multiple drive is dealt with in this article.

TYPES OF DRIVES. Progress and Problems in Mechanical Transformation of Energy (Fortschritte und Probleme der mechanischen Energie-Umformung), K. Kutzbach. Zeit. des Vereines deutscher Ingenieure, vol. 66, nos. 7 and 8, Feb. 18 and 25, 1922, pp. 154-159 and 183-185, 26 figs. Deals with indirect converter types. Status of belt and rope drive for long-distance conversion; increasing use of stretching pulleys for safe control of external tensions; problem of slip and friction, durability and bending losses. The Föttinger and the Lentz converters and their use for all kinds of vehicles.

WATER-TUBE TYPE ARRESTER. Water-Tube Type of Arrester Compares Favorably with Others, George H. Middlemiss. Electrical World, vol. 79, no. 17, Apr. 28, 1922, p. 838, 1 fig. Results of tests made by Ala. Power Co. comparing electric-valve and water-tube type of arrester.

PRECIPITATION

COTTRELL PROCESS. Electric Precipitation of Fumes by the Cottrell Process (Note sur la condensation électrique des fumées), M. Biver. Mémoires et Compte Rendu des Travaux de la Société des Ingénieurs Civils de France, vol. 74, nos. 10-12, Oct.-Dec. 1921, pp. 542-546, 1 fig. Describes installation at works of Société Nouvelle des Mines de la Lucette, for precipitation of dust from antimony ore roasting.

PRESSES

INCLINABLE. The Use of Inclinable Power Presses. Machy. (Lond.), vol. 19, no. 496, Mar. 30, 1922, pp. 787-788, 3 figs. Inclination of presses; classes of work readily performed on inclinable presses.

PULLEYS

DRIVING FOR HYDRO-EXTRACTOR. Driving Pulley for Hydro-Extractor. Textile World, vol. 61, no. 16, Apr. 22, 1922, p. 41, 3 figs. Centrifugal clutch pulley which does not put load on motor until it has attained good speed.

PULVERIZED COAL

COMBUSTION. The Carrying of Dust by a Current of Air (Étude de l'entraînement de poussière par un courant d'air), E. Audibert. Annales des Mines, vol. 1, no. 3, Mar. 1922, pp. 153-191, 3 figs. Discusses question of pulverized coal, especially arrangement of combustion chamber so as to assure complete combustion of dust.

OFFICE-BUILDING HEATING. Powdered Fuel. Nat. Engr., vol. 26, no. 5, May 1922, pp. 219-221, 1 fig. Results from installation in 42-story L. C. Smith building, Seattle, Wash.

STEAM BOILERS, FOR. Powdered Coal under Steam Boilers, H. D. Savage. Coal Trade Jl., vol. 52, nos. 36, 37, 38, 39, 40 and 41, Sept. 7, 14, 21, 28, Oct. 5 and 12, 1921, pp. 1003-1004, 1028-1029, 1049-1051, 1074, 1094-1095 and 1116-1117, 5 figs. Progress made in making powdered coal for steam production thoroughly reliable and efficient, and economic possibilities of this method of combustion.

TREATMENT AND USE. A New Pulverized Fuel Plant. Iron & Coal Trades Rev., vol. 104, no. 2821, Mar. 24, 1922, pp. 418-419, 2 figs. Describes coal dryer, conveyance and distribution of pulverized fuel, hopper and controller system.

PUMPS

SEMI-SOLID HANDLING. A Pump that Handles Semi-Solids. Elec. News, vol. 31, no. 9, May 1, 1922, p. 51, 2 figs. Particularly designed to pass unscreened sewage; rags, cotton waste, fibre and all kinds of pulp and trade effluent from textile works in general. Made in England.

PUMPS, CENTRIFUGAL

BALANCING, AUTOMATIC METHOD. Centrifugal Pumps, E. T. Keenan. Southern Engr., vol. 37, no. 3, May 1922, pp. 40-43, 7 figs. Automatic method of balancing; efficiency and losses.

PYROMETERS

NON-FERROUS FOUNDRY. Pyrometry in the Non-Ferrous Foundry. Eng. Production, vol. 4, no. 81, Apr. 20, 1922, p. 365, 1 fig. Notes on thermo-electric, resistance, radiation and optical pyrometers.

R

RADIO TELEPHONY

APPLICATION OVER POWER CIRCUITS. High Frequency Telephone as applied to High Tension Power Stations, A. S. Runciman. Eng. Jl., vol. 5, no. 5, May 1922, pp. 243-247, 5 figs. Experience of Shawinigan Water & Power Co. in applying methods to telephony over power circuits.

CENTRAL STATION, APPLICATION TO. Possibilities in Radio for the Central Station Company, J. C. Martin. Elec. World, vol. 79, no. 14, Apr. 8, 1922, pp. 673-676, 6 figs. Radiotelephone broadcasting apparatus on commercial basis. Difficulties which must be faced. Problems of regulation.

RAILS

DEFORMATION, MEASURING. Measuring Rail Deformation by Moving Picture Photography. Ry. Rev., vol. 70, no. 14, Apr. 8, 1922, pp. 483-484, 6 figs. partly on p. 485. Describes method for making observations of rail depression under a moving load by means of moving picture camera, and gives results of series of tests made on St. Louis-San Francisco Ry.

STEEL, ROLLED MANGANESE. Rolled Manganese Steel Rails. Ry. Gaz., vol. 36, no. 14, Apr. 7, 1922, pp. 597 and 601, 2 figs. Advantages claimed for built-up railway track work. Discusses lay-out of "Imperial" patent rolled manganese steel rails of Waterloo Station, Lond. & South Western Ry.

RAILWAY ELECTRIFICATION

INDUCTIVE INTERFERENCE AND ELECTROLYSIS. The Question of Inductive Interference and Electrolysis Relating to Railroad Electrification, Chas. F. Scott. Elec. Jl., vol. 19, no. 4, Apr. 1922, pp. 146-149. Consideration of various ways in which telephone service has been interfered with and pipe lines corroded, and means of overcoming difficulties.

ITALY. Electrification of the Italian Railways (L'Elettrificazione delle Ferrovie Italiane), C. Vita-Finzi. Elettricista, vol. 4, nos. 5 and 6, Mar. 1 and 15, 1922, pp. 37-38 and 44-46, 1 fig. Discusses electric traction, and necessity for Italy to electrify; new law for electrification of railroads. Gives list of trunk lines already electrified and list of lines to be electrified.

SINGLE-PHASE OVERHEAD SYSTEM. The Lancaster-Morecambe-Heysahm Electric Railway. Electrician, vol. 88, nos. 2281 and 2282, Feb. 3 and 10, 1922, pp. 124-129 and 155-156, 8 figs. Experiences of 14 years' working with single-phase overhead system. Failures and modifications which have been necessary in various parts of apparatus during the 14 years.

RAILWAY MOTOR CARS

NEW FEATURES. New Features in Service Railway Motor Coach. Ry. Age, vol. 72, no. 18, May 6, 1922, pp. 1069-1070, 3 figs. Service Motor Truck Co., Wabash, Ind., produces coach in which power plant and transmission follow regular motor truck practice but running gear is unique.

OPERATING COSTS. Motor Trucks Operate on Rails in City and Interurban Passenger Service. Mun. & County Eng., vol. 62, no. 4, Apr. 1922, pp. 18-22, 1 fig. City and Interurban Ry. Co., Manhattan, Kansas, has recently scrapped heavy electric cars and now operate four FWD railway cars.

RAILWAY OPERATION

AUXILIARY TRAIN CONTROL. The Sprague System of Auxiliary Train Control. Ry. Age, vol. 72, no. 16, Apr. 22, 1922, pp. 963-967, 9 figs. Apparatus undergoing daily test on section of New York Central operates on normal danger plan and leaves engineer practically undisturbed while on duty.

REVERSIBLE STEAM TRAIN. "Reversible" Steam Train, London & North Western Railway. Ry. Gaz., vol. 36, no. 17, Apr. 28, 1922, pp. 697-699, 5 figs. Describes push-and-pull train which has been working satisfactorily on local service in England.

RAILWAY TRACK

CONSTRUCTION. Adjusting Track Construction to the Lightweight Car, R. G. Taber. Elec. Ry. Jl., vol. 59, no. 18, May 6, 1922, pp. 755-756, 1 fig. Account of two track jobs recently completed in Fort Worth, in which advantage was taken of light weight of Birney cars operated there in cheapening construction. (Abstract.) Paper read before Southwestern Elec. & Gas Assn.

CURVES. The Design of Transition Curves for Railway Tracks (Zur Konstruktion des Uebergangsbogens für Eisenbahngleise), K. Lachmann and R. Rothe. Zeit. für angewandte Mathematik u. Mechanik, vol. 2, no. 1, Feb. 1922, pp. 45-78, 8 figs. It is claimed that methods of practical mathematics permit accurate solution of problem, not only for flat curves, but for transition curves for any given differences in direction.

RACK TYPE. Rack Wheel and Branch Lines (Zahnradanschlussbahnen), A. Wichert. Schweiz. Elektrotechnischer Verein Bul., vol. 13, no. 3, Mar. 1922, pp. 98-106, 6 figs. Describes cog wheel electric locomotive of Oker Metal and Color Works, in Harz Mountains, and loading and unloading arrangements at works with a difference in levels of 24 meters.

SHIFTING MACHINE. Track Shifting Machine, Friedr. Hübener. Eng. Progress, vol. 3, no. 4, Apr. 1922, p. 87, 2 figs. Describes Arbenz-Kammerer type, consisting essentially of portable bridge resting on two bogies; center of bridge carries frame which may be shifted over laterally.

RECTIFIERS

THERMIONIC TRIODE AS. The Thermionic Triode as Rectifier, E. B. Moullin and L. B. Turner. Electrician, vol. 88, no. 2291, Apr. 14, 1922, pp. 442-443 and (discussion) 443-444, 3 figs. Investigation of triode rectifier for signals of various strength with or without superposed local heterodyne oscillation.

REFRACTORIES

SOFTENING TEMPERATURE, DETERMINING. A New Device for Determination of the Softening Temperature of Refractory Materials under Load (Eine neue Vorrichtung zur Bestimmung der Erweichungstemperatur von feuerfesten Materialen unter Belastung), W. Steger. Berichte der Deutschen Keramischen Gesellschaft, vol. 3, no. 1, Feb. 1922, pp. 1-4, 1 fig. Describes press and heating device developed by author for use in Chemical-Technical Experimental Station of the State Porcelain Mfg. Works, Berlin-Charlottenburg.

REFRIGERATING PLANTS

AMMONIA FITTINGS, STANDARDIZATION OF. Standardization of Ammonia Fittings Necessary, Erwin Bunzel. Power, vol. 55, no. 15, Apr. 11, 1922, p. 581. Pointing out necessity of early adoption of code covering standardization of flanges for refrigerating systems.

RESERVOIRS

CONCRETE. Methods and Costs of Building 10 Million Gallon, Reinforced Concrete Reservoir for the Indianapolis Water Co., William Curtis Mabee. Mun. & County Eng., vol. 62, no. 4, Apr. 1922, pp. 141-145, 1 fig. Essentials of design and construction and cost thereof.

RIVERS

TERMINALS AND WATER DEPTHS. River Terminals and Water Depths, H. McL. Harding. Eng. World, vol. 20, no. 4, Apr. 1922, pp. 211-212. Discusses question of minimum depth of a waterway that will be a commercial success. European practice.

ROAD CONSTRUCTION

RESEARCH. Making Road Building an Exact Science Through Research Work, A. T. Goldbeck. Contract Rec., vol. 63, no. 16, Apr. 19, 1922, pp. 355-360. Experimental investigations are being carried out to provide basis for sound engineering design of highways; effect of impact, moisture, drainage and soil conditions.

ROADS

SUB-DRAINAGE. Comparison of Sub-Drainage by Deep Sode Ditches and Tile Drains, C. M. Upham. Good Roads, vol. 62, no. 18, May 3, 1922, pp. 247-250. Importance of eliminating moisture in road bed and means of accomplishing it.

ROADS, GRAVEL

SURFACE TREATMENT. Surface Treatment of Gravel Roads, Paul D. Sargent. Contract Rec., vol. 63, no. 18, May 3, 1922, pp. 391-394. Experiences of Maine State Highway Commission described in paper presented at annual conference on highway engineering, Ann Arbor, Mich.

ROCK CRUSHING

PLANTS. Capacity of Coast Plant About 12,000 Cars per Year, W. A. Scott. Cement Mill & Quarry, vol. 20, no. 8, Apr. 20, 1922, pp. 23-26, 7 figs. Grant Rock & Gravel Co. operations. Supplies large part of San Joaquin Valley. Gold is recovered by rifle system.

ROLLING MILLS

ELECTRIC DRIVE TROUBLES. Where to Look for Things that Cause Trouble in Reversing-Roll Electric Drives, Arthur J. Whitcomb. Elec. Rev. & Indus. Engr., vol. 80, no. 2, Feb. 1922, pp. 63-66, 103, 8 figs. Maintenance practice in reversing roll electric drives.

RUBBER

MAGNESIUM CARBONATE, COMPOUNDED WITH. Some Physical Properties of Rubber Compounded with Light Magnesium Carbonate, H. W. Greider. Jl. o Indus. & Eng. Chem., vol. 14, no. 5, May 1922, pp. 385-395, 22 figs. Dat showing increase in tensile strength, hardness and resilint energy and prob ability of eliminating principle disadvantages by compounding filler in amor phous form.

TRANSPARENT. Rubber Glass—A New Product of Great Interest. India Rubbe World, vol. 66, no. 2, May 1, 1922, pp. 538-539. Description of inventio of Fordyce Jones giving its advantages and limitations.

S

SAFETY ENGINEERING

GRAPHIC CHARTS. Obtaining and Presenting Safety Statistics for the Busy Executiv A. M. Underhill. Safety Eng., vol. 43, nos. 4 and 5, Apr. and May 192 pp. 131-134, 199-204, 7 figs. Apr.: Methods of presenting statistics for determ ining what steps may be taken to prevent repetition of accidents in such form that they become intelligible to executives not familiar with work. May Use of logarithmic paper for curve charts clearly shows accident increas or decrease.

PLANTS AND METHODS. Sand Blasting, E. L. Samson. Foundry Trade Jl., vo 25, nos. 287 and 288, Feb. 16 and 23, 1922, pp. 115-118 and 143-144, 19 fig High versus low-pressure plants; abrasive power considerations; cost of san blasting; sand-blast rooms, cabinets and tumbling barrels; sand-blast convey ors; dust collecting; etc. Paper read before Instn. British Foundrymen.

SAND, MOLDING

DRESSING. The Dressing of Moulding Sand, Heinz Kalpers. Eng. Progress, vo 3, no. 4, Apr. 1922, pp. 79-81, 5 figs. Notes on dressing of fresh sand, use sand and coal dross; drying furnaces for fresh sand; shaking sieves; sand-crush ing mills with magnetic rollers, automatic dressing plants.

PREPARATION. Sand Offers Field for Improvement, Eugene W. Smith. Foundry vol. 60, no. 7, Apr. 1, 1922, pp. 264-265. Factors besides physical cha acteristics and chemical analysis entering into preparation, classificatin and grading of sand used in preparation of molds into which metal is poure From paper read before Chicago Foundrymen's club.

SCRAP

DE-LEADING. De-leading of Scrap Metals (Das Entbleien von Altmetallen). Meta —Technik, vol. 48, no. 10, Mar. 4, 1922, pp. 92-93. Discusses wet and dr methods and describes operations.

METAL, DE-ZINCIFICATION. De-zincing of Scrap Metal (Das Entzinken von Al metallen), B. Haas. Zeit. für die gesamte Giessereipraxis, vol. 43, no. 1 Mar. 25, 1922, p. 154. Thermal and chemical processes used. Conclud that de-zincification is more reliable and simpler than de-leading.

SEMI-DIESEL ENGINES

TWO-CYLINDER MARINE. New Two-Cylinder Semi-Diesel Marine Oil Engine. Eng. & Finance, vol. 1, no. 2, Mar. 25, 1922, pp. 369-370, 1 fig. Design f small commercial vessels two-cycle hot-bulb developing 30 b.hp. at 425 r.p.

SEWAGE DISPOSAL

COLLOIDS. Colloids and Sewage Disposal, F. W. Mohlman and Langdon Pear Eng. World, vol. 20, no. 5, May 1922, pp. 301-303. Relation of colloid che istry to tank treatment of sewage; method of study; determination of collo and results of processes for their removal.

CONNECTICUT SLUDGES. Characteristics of Some Connecticut Sludges, J. Frederi Jackson and Joseph Doman. Surveyor, vol. 61, no. 1580, Apr. 28, 19 p. 357. Describes experiments with samples from grit chambers, screeni chambers, Imhoff tanks, Mile's acid tanks, lime tanks and activated tan (Abstract.) Paper published in Jl. Boston Soc. of Civil Engrs.

Imhoff Tank. Imhoff Tank Results, [illegible] R. [illegible] Eng. Works, vol. 52, no. 17, Apr. 29, 1922, pp. 304-305. [illegible] of Imhoff tank and extent to which they are justified by results.

Sludge Handling. Treatment of Sludge in the Plants of the [illegible] Association (Die Schlammbehandlung in den Anlagen der [illegible]), [illegible] Prüss. Glückauf, vol. 58, no. 11, Mar. 18, 1922, pp. [illegible], [illegible] figs. Treatment of sludge from septic tanks, pumping arrangements, drying of sludge.

Small Municipalities. Sewage Disposal for Small Municipalities. Can. Engr., vol. 42, no. 17, Apr. 25, 1922, pp. 421-423. Report of Committee on Sewage and Sanitation Presented at Convention of Am. Soc. for Municipal Improvement, Baltimore.

Treatment. Sulphur Dioxide for Sewage Treatment. Chem. Age (Lond.), vol. 6, no. 149, Apr. 22, 1922, pp. 508-509. In recent paper before Engrs. Soc. of Western Pa. F. W. Mohlman points out that sulphur dioxide has certain advantages over sulphuric acid in this field.

SEWER CONSTRUCTION

Kansas City, Mo. Constructing the Turkey Creek Sewer in Kansas City, Missouri, Paul A. Hartung. Mun. & County Eng., vol. 62, no. 4, Apr. 1922, pp. 125-128, 3 figs. Installation which will provide against flood water menace in vast terminal and industrial section of Kansas City.

SHERARDIZING

Factors Influencing Process. Factors Influencing the Process of Sherardizing, Leon McCulloch. Elec. Jl., vol. 19, no. 4, Apr. 1922, pp. 156-160, 4 figs. Experiments in features not hitherto definitely known. Growth of coating, effect of iron in zinc dust, effect of other metals in zinc dust, composition of coatings.

SHIP DESIGN

Transverse Sections. The Influence of Shape of Transverse Sections Upon the Resistance of Vessels of Moderate Speed, Herbert C. Sadler and E. M. Bragg. Mar. Eng., vol. 27, no. 5, May 1922, pp. 320-324, 10 figs. Results of experiments showing that no hard and fast rule can be laid down as to best type of bow and stern sections for all ships at all speeds, and that best type of section will depend upon speed-length ratio, fullness of vessel, distribution of displacement longitudinally, and ratio of breadth to draft. Paper read before Soc. Naval Architects & Mar. Engrs.

SIDEWALKS

Concrete Slabs, Tests. Tests on Concrete Slabs for Sidewalks (Essais de dalles en aggloméré de ciment pour trottoirs), A. Grebel. Génie Civil, vol. 80, no. 15, Apr. 15, 1922, pp. 339-342, 4 figs. Slabs are divided into squares on surface. Results of breaking, compression and hardness tests of various kinds of slabs. Mechanical tests as to wear.

SILVER DEPOSITS

Cobalt. Cobalt—Its Past and Future, Cyril W. Knight. Eng. & Min. Jl.-Press, vol. 113, no. 18, May 6, 1922, pp. 761-768, 4 figs. Study of geology of district in light of recent survey; principles worked out by miller proved correct, important structures revealed by operations of past decade; years of silver mining probably remain.

SMOKE ABATEMENT

Water-grates. Abating a Smoke Nuisance, R. R. Hillman. Power Plant Eng., vol. 26, no. 9, May 1, 1922, pp. 463-465, 3 figs. Treatment of an unique case in department store in Buffalo where water-grates also increased circulation of boiler water.

SOOT BLOWERS

Steam Consumption. Steam Used for Soot Blowing, Robert June. Power Plant Eng., vol. 26, no. 38, Apr. 15, 1922, pp. 414-415, 4 figs. Method of calculating steam consumption when time valve is open is known. See also Power House, vol. 15, no. , Apr. 5, 1922, pp. 30-31, 4 figs.

SPECIFIC HEAT

Gas. The Specific Heats of Gas From the Point of View of Their Industrial Application (Sur les chaleurs spécifiques des gaz envisagés au point de vue de leur application aux problèmes industriels), Emilio Damour and D. Wolkowitsch. Revue de Métallurgie, vol. 19, no. 3, Mar. 1922, pp. 145-161, 2 figs. Reviews in detail literature on subject, and shows that there is no agreement between the various authorities.

SPRINGS

Impact, Absorption of. Graphic Representation of Absorption of Impact by Springs. Machy. (Lond.), vol. 20, no. 499, Apr. 20, 1922, pp. 93-94, 2 figs. Description of graphic method to determine energy absorbed under certain simple conditions.

STACKS

Venturi. New Stack Type, A. W. H. Griepe. Am. Gas Jl., vol. 116, no. 15, Apr. 15, 1922, pp. 343-346, 18 figs. New type similar in shape to a Venturi tube combined with blower has advantage of flexibility of operation, and low cost of installation and maintenance.

STANDARDIZATION

Reducing Cost. Reducing the Cost of Standardization, W. O. Lichtner. Management Eng., vol. 2, no. 5, May 1922, pp. 275-280. Need and possibilities of handbook of times for performing manufacturing operations including charts and tables showing elementary operations analyzed to simplest items.

STEAM

High-Pressure. Higher Steam Pressures, Joseph Jares. Combustion, vol. 6, no. 5, May 1922, pp. 221-223, 1 fig. Consensus of opinion of most writers favors higher pressures and temperatures. Advantages. Letters from C. J. Stover, Sec'y of Magnesia Assoc. of Am., and W. S. Lockwood of Johns-Manville, Inc.

The Properties of Steam under High Operating Pressures (Bemerkungen zu den Eigenschaften des Wasserdampfes bei hohen Betriebsdrücken), G. Eichelberg. Zeit. des Vereines deutscher Ingenieure, vol. 66, no. 12, Mar. 25, 1922, pp. 275-277, 6 figs. Differences in the values for heat of evaporation obtained by Schule and Eichelberg. Possibility of indirect measurement of specific heat of saturated steam based on relation between exponent of the adiabatic curve, heat of evaporation and specific heat.

Metering of. The Metering of Steam, John L. Hodgson. Shipbldg. & Shipg. Rec., vol. 19, no. 15, Apr. 13, 1922, pp. 466-468, 5 figs. Steam meters developed by author and his firm, Geo. Kent, Ltd., during last twelve years.

Specific Heat of Superheated. The Specific Heat of Superheated Steam for Pressures of 20 to 30 Atmos. (Die spezifische Wärme des überhitzten Wasserdampfes fur Drucke von 20 bis 30 at.), Osc. Knoblauch. Zeit. für technische Physik, vol. 3, no. 2, 1922, pp. 39-40. Results of tests carried out in conjunction with E. Raisch.

STEAM ENGINES

Heat Economy. Using the Heat of Piston Steam Engines to Best Advantage (Die Wärmeausnutzung der Kolbendampfmaschine), W. Schmidt and R. Wolf. Zeit. des Vereines deutscher Ingenieure, vol. 66, no. 14, Apr. 8, 1922, pp. 345-350, 4 figs. Discusses increase of pressure from 18 to 55 atmos., increase in expansion of steam, intermediate superheating, etc. on basis of latest experiments by W. Schmidt and R. Wolf.

1

Indicator Diagrams. Indicator Diagrams. Power, vol. 55, no. 15, Apr. 11, 1922, pp. 574-576, 28 figs. Contains diagrams from Corliss, uniflow and non-releasing gear valve engines.

STEAM PIPES

High Pressure. Safety in High-Pressure Piping of Steam Power Plants (Die Sicherheit beim Betrieb von Hochdruckrohrleitungen in Dampfkraftanlagen), H. Melk. Wärme, vol. 45, no. 4, Jan. 27, 1922, pp. 56-59, 11 figs. Discusses measures and devices employed for increasing safety in use of such pipes.

STEEL

Defective Points, X-Ray Examination. Fundamentals for Determination of Defective Points in Steel by Means of X-Rays (Grundlagen für die Feststellung von Fehlstellen in Stahl mittels Röntgenstrahlen), E. H. Schulz. Stahl u. Eisen, vol. 42, no. 13, Mar. 30, 1922, pp. 492-496, 19 figs. Describes apparatus for examination with X-rays, and results obtained; depth of irradiation; investigation of welding points.

Molybdenum. *See Molybdenum Steel.*

Structural. *See Structural Steel.*

STEEL, HEAT TREATMENT OF

Ball Bearings, for. Ball Bearing Steel and its Heat Treatment, Carl T. Hewitt. Forging & Heat Treating, vol. 8, no. 4, Apr. 1922, pp. 196-198, 4 figs. Use of steels of from 0.60 to 1.50 per cent chromium content to meet extreme service demands. Methods of annealing and of hardening.

Hardening in Tempering Furnace. The Hardening of Steel Parts in Tempering Furnace (Das Härten von Eisenteilen im Härteofen). Zeit. für die gesamte Giessereipraxis, vol. 43, nos. 10 and 11, Mar. 11 and 18, 1922, pp. 129-131 and 142-144. Notes on proper design of furnace and methods of hardening.

Problems. Heat Treatment Problems II, Leslie Aitchison. Metal Industry (Lond.), vol. 20, no. 5, Feb. 3, 1922, pp. 113-115, 3 figs. Deals with problems of cooling.

Tests. Relation of Time for Heating Round Sections to Surface per lb. of Steel Exposed, E. J. Janitzky. Forging & Heat Treating, vol. 8, no. 4, Apr. 1922, pp. 179-181, 2 figs. Discusses experiments carried on by M. E. Leeds, results having been presented in paper, "Some Neglected Phenomena in the Heat Treatment of Steel," before Am. Soc. for Testing Mtls. and published in A.S.T.M. Proc., vol. 15, 1915.

STEEL MANUFACTURE

Basset Process. Blast Furnace Eliminated from Steel Making. Indian Industries & Power, vol. 19, no. 7, Mar. 1922, pp. 235-236. Some unsubstantiated reports of process discovered by Basset for producing steel direct from ore. Being tried out in Sheffield.

STEEL WORKS

British. Famous British Works. Eng. Production, vol. 4, nos. 77 and 78, Mar. 23 and 30, 1922, pp. 266-268 and 290-292, 9 figs. Describes works of Armstrong, Whitworth & Co., Ltd., shipbuilders and manufacturers of locomotives, marine engines, brass and non-ferrous metals, steel products, pneumatic tools, etc. Mar. 23: The Openshaw works devoted chiefly to manufacture of steel, armor plate, machine tools, etc. Mar. 30: The North Street works, representing later extensions to Openshaw works, and including large steel departments.

Electric, Southern Pacific Shops. Electric Steel Plant at the Southern Pacific Shops, Larry J. Barton. Chem. & Met. Eng., vol. 26, no. 18, May 3, 1922, pp. 838-840, 2 figs. Six-ton Heroult furnace produces all steel castings for large Western railways as a side line. For a year it produced rivet steel from miscellaneous scraps, and now is working on order for 1,900,000 tie plates.

Power Plant. Power Plant Designed for Steel Mill Conditions. Power, vol. 55, no. 15, Apr. 11, 1922, pp. 566-570, 7 figs. Describes Inland Steel Co.'s plant no. 2, Indiana Harbor. Boilers are equipped with underfeed and forced-draft chain-grate stokers. Coke braize, coal and coke-oven and blast-furnace gas used as fuel. Combination of four feedwater heaters operated in parallel.

Controlling Excavations in Roadbed. Controlling Excavations Through Right-of-Way, R. B. Genest. Elec. Ry. Jl., vol. 5, no. 17, Apr. 29, 1922, pp. 703-707, 17 figs. Montreal, Que., system wherein railway sanctions digging operations affecting its track and is compensated for expense therewith.

France. Present State of the Tramway Industry (État actual de l'Industrie des Tramways), Roger Vente. Revue Industrielle, vol. 52, no. 6, Apr. 1922, pp. 183-189, 13 figs. Describes present practice in Paris: construction of tracks, rails, rolling stock, first and second class cars.

Track. Expediting Track Construction in Toronto. Elec. Ry. Jl., vol. 59, no. 13, Apr. 1, 1922, pp. 551-558, 31 figs. Describes work in connection with relaying of tracks; gives standards of Toronto Transportation Commission.

STRUCTURAL STEEL

Wheels from I Beams. Fabrication of First Structural Steel Wheel, W. R. Ward. Forging & Heat Treating, vol. 8, no. 4, Apr. 1922, pp. 184-188, 13 figs. Difficulties encountered and problems solved in early experimental stage of construction of I-beam structural steel wheel.

STOKERS

Correcting Troubles in. Draft, Joseph G. Worker. Combustion, vol. 6, no. 5, May 1922, pp. 232-234, 240, 4 figs. Main points from forthcoming book, Mechanical Stoker, by J. G. Worker and T. A. Peebles. Draft one of most important features in correcting stoker troubles.

Mechanical. The Principal Types of Mechanical Stokers. Power House, vol. 15, no. 8, Apr. 20, 1922, pp. 19-21, 6 figs. Discusses chain grate, underfeed, and overfeed stokers. Choice of stokers.

Multiple Underfeed. A New Type of Multiple Underfeed Stoker, Robert June. Power House, vol. 15, no. 8, Apr. 20, 1922, pp. 35-37, 7 figs. Many advantages described and curves of both calculated and actual performance given.

Sprinkler. Sprinkler Stokers in a Mill Power Plant. Power House, vol. 15, no. 8, Apr. 20, 1922, pp. 24-25, 2 figs. Small type requiring practically no special brick work, readily applied to any style boiler without structural alterations.

SUBSTATIONS

Automatic. The Economics of Direct Current Railway Distribution with Particular Reference to the Automatic Substation, Lawrence P. Crecelius and Victor B. Phillips. Am. Inst. Elec. Engrs. Jl., vol. 41, no. 5, May 1922, pp. 363-378, 9 figs. Comments on automatic sub-station in connection with general economics of current distribution.

Fire Prevention in Electric. Equipping Electrical Substations for Fire Prevention and Safety. Safety Eng., vol. 43, no. 4, Apr. 1922, pp. 136. Features of design and installation that should not be neglected.

Outdoor. Safe, Simple and Compact Construction, M. M. Samuels. Elec. World, vol. 79, no. 14, Apr. 8, 1922, pp. 681-682, 12 figs. Construction features of outdoor substation serving Rock Point, L.I., radio station.

SURVEYING

PHOTO-TOPOGRAPHICAL. The "Canadian" Photo-Topographical Method of Survey, E O Wheeler Royal Engrs Jl, vol 35, no. 4, Apr. 1922, pp. 177-185, 5 figs. Describes Canadian method in which axis must be truly horizontal, i e, a true perspective of country to be mapped is used, while airplane photographs are taken with optical axis pointing vertically downwards.

STADIA DISTANCE TABLE. Stadia Distance Table, Ray S Owen. Wisconsin Engr., vol 26, no 7, Apr 1922, pp 129-130 Method of determining constants in well-known formulas and preference over graduating rod to fit stadia wires.

SWITCHBOARDS

TELEPHONE INFORMATION. Information Switchboard for the Paris Telephone System (Les tables de renseignements du réseau téléphonique de Paris). Annales des Postes, Télégraphes et Téléphones, vol. 11, no 1, Jan.-Feb 1922, pp 183-196, 4 figs. Describes facilities for telephone operators to get in touch with subscribers in case of interrupted communication; etc.

T

TANKS

REINFORCED-CONCRETE. Reinforced-Concrete Storage Tanks (Réservoirs en Béton Armé), G Ollivier Arts et Métiers, vol 75, no 17, Feb. 1922, pp. 36-38, 9 figs Calculation of various types, square section, rectangular, great and small height, large and small bottom surfaces, etc.

TELEPHONY

AUTOMATIC. Calculation of Blocking Factors of Automatic Exchanges, Ragnar Holm P O Elec Engrs Jl., vol 15, pt. 1, Apr. 1922, pp. 22-38, 8 figs. Study of ratio of number of calls not effectuated to total number of calls during given time.

DIALLING-IN OVER CABLES. Dialling-In Over Long Superposed Cables, G. M. B. Shepherd P O Elec. Engrs Jl, vol 15, pt 1, Apr 1922, pp 17-22, 3 figs. Some laboratory experiments on transmission of dial signals over phantomed and repeatered cables.

RECEIVERS. Telephone Receiver with Increased Sound Intensity (Ein Fernhorer mit erhohter Lautstarke), Georg Seibt Elektrotechnische Zeit, vol 43, no 9, Mar 2, 1922, pp 269-270, 5 figs. It was found possible to increase sound intensity of telephone receiver by laminating pole pieces above poles of permanent magnet and by introducing magnetic shunt just below coils. Tests with such receivers show increase of sound intensity of from 2 to 2 4 times that of old model. It is already being made on large scale.

TEMPERATURE MEASUREMENT

THERMOPHONE. The Thermophone, Edward C. Wente Physical Rev., vol 19, no 4, Apr 1922, pp. 333-345, 6 figs. Acoustic efficiency of thermophones of heated foil or wire type Methods of calibrating acoustical transmitters and of measuring thermal conductivity of gas by using thermophone.

TESTING MACHINES

METAL RESISTANCE OF. New Method of Testing Wear in Metals (Nouvelle méthode d'essai des métaux à l'usure), L. Jannin Revue de Métallurgie, vol. 19, no. 2, Feb 1922, pp 109-116, 11 figs. Describes machine for testing resistance of axle and bearing metals to wear. Pages 117-119, article by Léon Guillet on some friction tests carried out with the Jannin wear-testing machine.

MODULUS OF ELASTICITY, FOR. A New Testing Machine Giving the Elastic Limit and the Modulus of Elasticity (Nouvelle machine de traction donnant la limite élastique et le module d'élasticité), R. Guillery. Revue de Métallurgie, vol 19, no 2, Feb. 1922, pp. 101-108, 7 figs. Describes apparatus and its operation.

TESTS AND TESTING

TURBINES. Equipment for Testing Turbines and Generators, C. O. Schooley. Elec Jl, vol 19, no 4, Apr 1922, pp. 163-166, 4 figs Description of what is said to be model test floor for both steam and electrical equipment at S. Phila plant of Westinghouse Elec & Mfg Co.

TIDAL POWER

EXPERIMENTAL STATION. Project of an Experimental Tidal Power Station (Idées générales et pratiques pour l'établissement d'un avant-projet de station marémotrice avec usine régulatrice), M Bare. Annales des Ponts et Chaussées, vol 6, Nov.-Dec 1921, pp 252-289, 15 figs. Discusses proposed station at Aber-Wrac'h, near Brest; design and calculation of works, power control, etc.

TIMBER

TREATMENT. Treated Bridge Timbers Have Long Life, A. F. Robinson. Contract Rec, vol 63, no 17, Apr. 26, 1922, pp 379-380. Experience with creosoted wood on Sante Fe System Forty year life seems possible. Troubles with treated timber and methods of overcoming them.

TIME STUDY

MOTION STUDY AND. Time and Motion Study VI, Eric Farmer. Eng & Indus Management, vol. 7, no 12, Apr. 20, 1922, pp 361-365, 7 figs. Experiments in bottling sweets and covering and packing chocolates. (Concluded)

TOOL STEEL

SELECTION AND HEAT TREATMENT. Selection and Heat Treatment of Tool Steel, S C Spaulding. Blast Furnace & Steel Plant, vol 10, no 4, Apr 1922, pp 224-227 Discusses the various factors to be considered in selection of proper steel for a tool.

TOOLS

FINE. Engineers' Fine Tools .Machy. (Lond), vol 20, no 497, Apr 6, 1922, pp. 1-7, 21 figs Methods and equipment used in quantity production by C A Vandervell & Co, Ltd, including various types of calipers, V-blocks, and clamps.

MANUFACTURE OF SMALL. A Small Tools Factory. Eng. Production, vol. 4, no. 78, Mar 30, 1922, pp. 307-311, 14 figs. Describes equipment in works of C A Vandervell & Co, Ltd.

TRANSFORMERS

HIGH-VOLTAGE. Westinghouse Builds Highest-Voltage Single Transformer. Elec Rev, vol 81 no 5, May 1922, pp 338, 1 fig. Description of Westinghouse Elec Mfg Co unit capable of delivering one million volts above ground.

TRANSPORTATION

[illegible] CAR AND AUTOMOBILE. What the Trolley Car Has to Learn from the [illegible] H L Andrews Gen Elec Rev., vol 25, no 5, May 1922, pp 2[illegible]-284, 3 figs Analysis of preference of public for automobile over [illegible] and suggestions for reclaiming of patronage by latter.

TUBES

AUTOMATIC SEAM WELDING. Automatic Seam Welding and the Manufacture of Tubes, [illegible] Anderson Acetylene Jl, vol 23, no 10, Apr 1922, pp 183-188, 13 figs. Describes process of manufacturing welded tubing which, it is claimed, makes possible production of thin-walled tubing at fraction of cost of seamless steel tubing.

TUNGSTEN

BRIGHTNESS OF. Brightness of Tungsten, W. E Forsythe Physical Rev., vol 19, no 4, Apr 1922, pp 436-457. Three methods of measurement for wide-range temperature.

TUNNELLING

METHOD IN WET GROUND. Methods of Tunnelling in Wet Ground, W. G. Cameron. Contract Rec, vol 63, no 17, Apr. 26, 1922, pp 365-368, 8 figs. Survey of most approved practice in sewer construction under various underground conditions. Types of timbering. Compressed air installation.

V

VALVES

ENGINE, SETTING. Setting Valves by Elliptical Diagram, Arthur O. Gates. Power Plant Eng., vol 26, no. 8, Apr. 15, 1922, pp 410-413, 1 fig. New method employed on marine engine when time for shutdown was limited.

VENTILATION

AUTOMATIC. Recent Tests on Automatic Ventilators, A. J Mack and C J Bradley. Heat & Vent Mag, vol 19, no. 4, Apr. 1922, pp 36-38, 1 fig. Results of tests at Eng Experiment Station, Kan. State Agri College.

PRESENT-DAY PRACTICE. Where We Are At in Present-Day Ventilating Practice, Nelson S. Thompson. Heat & Vent Mag, vol. 19, no 4, Apr 1922, pp. 27-32, 1 fig Comments on conditions how sought through installation and operation of properly designed air-supply system.

VIADUCTS

REINFORCED-CONCRETE. The Broad Street Viaduct, J D. Tuller. Cornell Civil Engr., vol. 30, no 7, Apr. 1922, pp. 99-102 and 105, 1 fig. Discusses methods used and problems encountered in construction of viaduct across Bronx River, connecting Mt. Vernon and Yonkers, NY.

W

WASTE

INDUSTRIAL, MEASURING. Measuring Waste in Industry, C. E. Knoeppel Taylor Soc Bul, vol. 7, no 2, Apr 1922, pp 69-76 and (discussion) pp 76-80 Examination of method employed by Committee on Elimination of Waste in Industry of Federated Am Eng. Societies

WATER FILTRATION

RESEARCH. The Circulation of Water in Artificial and Natural Filters and in the Ground (Étude de la circulation de l'eau dans les filtres artificiels ou naturel et dans les terrains meubles), P Questienne Annales de la Société Geologiqu de Belgique, vol 44, no 2, Jan 31, 1922, pp M57-M120, 66 figs Mathematic paper discussing vertical, inclined or horizontal filters, and applying same reasoning to underground water.

RESIDUAL ALUM. Some Facts About Residual Alum in Filtered Water, A. M. Buswell & G. P. Edwards. Chem. & Metal Eng., vol 26, no 18, May 3, 1922, pp 826-829, 2 figs. Graphic representation of chemistry of alum coagulation process emphasizes interdependence of various equilibria and importance of hydrogen-ion concentration Use in explaining discrepancies in data on alkalinity changes and residual alum.

WATER PIPES

METAL, CORROSION OF. The Corrosion of Metal Water Pipes (Die Korrosion metallener Wasserleitungsrohren), Hugo Kühl. Gas- u. Wasserfach, vol 65, no 7, Feb. 18, 1922, pp 99-102. Discusses corrosion of lead, copper, zinc and iron pipe, its injurious effects, and preventive measures.

WATER POWER

CANADA. Installed Water Wheel Capacity in Canada Totals 2,763,000 hp. Contract Rec., vol. 63, no 16, Apr. 19, 1922, pp. 341-346. Résumé of water power resources of Dominion, brought up to date by Water Power Branch, Dept. of Interior, shows 300,000 hp. added during 1921.

CANADIAN RESOURCES. Water Power Resources of Canada. Eng. World, vol 20, no. 5, May 1922, pp. 284-285. Installed water wheel capacity now totals 2,763,000 hp. and many further enterprises are in prospect.

CHEMICAL INDUSTRY, DEVELOPMENT. Water Power Development and Progress in the Chemical Industries (Le développement de la houille blanche et le progrès des industries chimiques), Georges Kimpflin. Vie Technique et Industrielle, vol. 3, no. 30, Mar. 1922, pp. 479-486, 18 figs. Discusses hydroelectric plant of Cie d'Électricité Industrielle, with a head of 95 m. water storage; pressure conduits; electric equipment; 120,000 volt transmission; cyanamide, calcium carbide etc. manufacture.

WATER SUPPLY

CATSKILL AQUEDUCT. New York Catskill Mountain Water Supply, A. A. Northrop. Stone & Webster Jl, vol. 30, no. 4, Apr. 1922, pp 305-318, 11 figs Outstanding features of construction and capacity of New York water supply system as plan proposed twenty-five years ago near completion.

WATER WORKS

RICHMOND HILL, ONT. Water Works System at Richmond Hill, Ont, G H Baker Can Engr, vol. 42, no. 18, May 2, 1922, pp 437-439, 5 figs. Eight million gallon capacity reservoir; old earth dam rebuilt with concrete core wall, filters and pumps in one building with coagulation basin adjoining and clear water reservoir under pump house.

WATTMETERS

ALTERNATING CURRENT. The Electrostatic Wattmeter, G. L. Addenbrooke Electrician, vol 88, no 2292, Apr. 21, 1922, pp. 466-469, 1 fig. Application of quadrant electrometer to measurement of alternating currents and dielectric losses.

WELDING

AUTOGENOUS. *See Autogenous Welding.*

NON-FERROUS AND DISSIMILAR METALS. Welding Non-Ferrous and Dissimilar Metals, Fred E. Rogers. Can. Machy., vol. 27, no. 10, Mar. 9, 1922, pp. 26-28, 2 figs. Welding of aluminum and aluminum containers; welding of copper; brass and bronze; nickel; monel metal; etc.

OXY-ACETALINE. *See Oxy-Acetalene Welding.*

PIPE CONSTRUCTION. Possibilities of the Art of Welding in Pipe Construction, Frederick K. Davis. Heat. & Vent. Mag., vol. 19, no. 4, Apr. 1922, pp. 33-36, 12 figs. Few of typical methods including autogenous or local fusion by which manufacture has been greatly simplified.

WIRE DRAWING

PROCESS. Fascinating Romance of Wire Drawing, John Kimberly Mumford. Raw Material, vol. 5, no 3, Apr 1922, pp. 91-94, 4 figs. Discusses wire drawing methods of J. A Roebling's Sons Co. and R. L. Stillson Co.

Z

ZINC

EXTRACTION. New Methods for Extracting Zinc From Its Ores (Nuovi processi di estrazione dello zinco dai suoi minerali), Gaetano Castelli. Rassegna Numeraria Metallurgica e Chimica, vol. 56, no. 2, Feb. 28, 1922, pp. 21-24, 3 figs. Discusses new method using a reverberatory furnace and an improved sulphate method, and gives diagrams of operations

ZINC ALLOYS

RESEARCH. Research Work on Zinc and Zinc Alloys, Wallace Dent Williams. Can. Foundryman, vol 13, no 4, Apr 1922, pp 24-26, 9 figs. Influence of copper, aluminum and iron additions; influence of temperature upon defects of castings, etc.

Engineering Index

This Index is prepared by the American Society of Mechanical Engineers.

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A

ACCIDENT PREVENTION

MINES. An Inventory of Results of Accident Prevention, C. A. Allen. Trans. Amer Inst. Min & Met Engrs. issued with Min. & Metallurgy, May 1922, no 1155 M. 9 pp., 8 figs. Facts and figures in effort to reduce fatalities in Utah.

ACETYLENE

GENERATING PLANT. Acetylene Generator, Messer & Co. Type (Oberflur-Azetylenentwickler, Bauart Messer & Co.). Zeit. fur komprimierte u flussige Gase, vol. 22, no. 2, 1922, pp. 17-21, 3 figs. Detailed description. Freedom from risk, automatic charging of carbide, its complete gasification.

AERONAUTICAL INSTRUMENTS

OPERATION RECORDERS. Showing An Aviator How He Flies. Aviation, vol 12, no. 23, June 5, 1922, pp. 658, 659, 2 figs. Three special instruments developed by N.A.C.A. for accurately recording aviator's operations and performances of aeroplane in flight. See also Aerial Age, vol. 15, no. 11, May 22, 1922, p. 249.

AERONAUTICS

AERIAL LAWS AND SAFETY SURVEY. Aerial Laws and Survey of Safety in Flight Urged by Aeronautical Chamber of Commerce. Aerial Age Weekly, vol. 15, no. 11, May 22, 1922, pp. 246-247. Report of Aeronautical Chamber of Commerce points out meager capital, insufficient terminal facilities, popular doubt as to reliability, and need of aerial code, as hindrances to development.

AIR COMPRESSORS

FOUNDRY. The Compressor for Foundry Purposes. Compressed Air Mag., vol. 27, no. 6, June 1922, pp. 159-161, 5 figs. Lubricating system, method of regulation, air receiver and aftercooler have much influence upon operation of pneumatic devices.

AIR FILTERS

VISCO. A New Form of Air Filter. Engineer, vol. 133, no. 3456, Mar. 24, 1922, pp. 339-340, 2 figs. Describes Visco air filter, in which filtering medium consists of an innumerable mass of short rings cut from very thin copper-red steel tubing, coated with film of mineral oil termed Viscinol. See also Elec. Rev., vol. 90, no. 2321, May 19, 1922, p. 717.

AIR PUMPS

"DELAS" AIR EXTRACTOR. Tests of a "Delas" Air Extractor. Elec. Ry. & Tramway Jl., vol. 46, no. 1130, May 12, 1922, pp. 205, 207-208, 3 figs. Results of test on Delas Air Extractor manufactured by Société Condenseurs Delas with regard to its use in reducing steam consumption.

AIRCRAFT

PERFORMANCE TESTING. Performance Testing of Aircraft, T. M. Barlow. Aeronautical Jl., vol. 26, no. 137, May 1922, pp. 152-176, 21 figs. Outline of method carried out in England with special reference to routine at R.A.F. Aeroplane Experimental Establishment, Martlesham Heath.

AIRPLANE ENGINES

DESIGN. Aeronautical Engines, Their Evolution and Actual Tendencies (Les moteurs d'aviation, évolution, tendances actuelles), Martinot-Lagarde. Bul. de la Société d'Encouragement pour l'Industrie Nationale, vol. 134, no. 3, Mar. 1922, pp. 187-222, 23 figs. Commercial and military engines; characteristics of aeronautical engines, their mechanical construction, efficiency; engines for high altitudes; supercharging; etc.

ESTIMATING PERFORMANCES IN FLIGHT. Method for Estimating Power and Fuel Consumption of Normal Compression Aviation Engines in Flight at Various Altitudes. Air Service Information Circular, vol. 4, no. 317, Mar. 15, 1922, 6 pp. Object of report is to furnish standard method for estimating performance.

AIRPLANES

FUEL TANKS, SAFETY. Safety Fuel Tanks for Aeroplanes. India-Rubber Jl., vol. 63, no. 18, May 6, 1922, pp. 17-19, 5 figs. Air Ministry prize of r-1400 in official competition for petrol tanks used in aircraft won by I.R.G.P. Co. with an interesting rubber covered tank. Describes tests and the successful Silvertown tank. See also Aeroplane, vol. 22, no. 19, May 10, 1922, pp. 336 and 338.

TIRES AND WHEELS. Discussion of Airplane Tires and Wheels. Air Service Information Circular, vol. 4, no. 303, Feb. 15, 1922, 11 pp. 8 figs. Notes on wheel designs, rims, wheel facing, hub attachment, tires, physical tests of wheels and of tires, designers' ilmitations, etc. Presents charts showing load deflection for airplane tires of standard sizes.

WING SPARS. The Design of Wing Spar Sections, E. P. Warner. Aviation, vol. 12, no. 22, May 29, 1922, pp. 626-627, 2 figs. Develops formulas and gives curves.

ALIGNMENT CHARTS

D. C. MACHINES. Nomographic Methods for the Predetermination of D.C. Machines (Eine nomographische Methode zur Voraus-berechnung von Gleichstrommaschinen), Peter Frhr. von Stritzl. Archiv für Elektrotechnik, vol. 11, no. 1, Apr. 15, 1922, pp. 21-40, 12 figs. Construction of monograms and how to use them

ALLOYS

See Aluminum Alloys, Copper Alloys, Ferronickel, Magnesium Alloys, Phosphor-Bronze..

ALUMINUM

SOLDERS FOR. Investigation of Some Solders for Aluminum. Air service Information Circular, vol. 3, no. 298, Feb. 15, 1922, 1 fig. Determination of effect of small additions of aluminum, copper, magnesium, on alloys of tin-zinc base used for aluminum soldering.

USES. Aluminum and Its Utilization (Die Verwendungsgebiete des Aluminiums), J. Czohralski. Zeit. für Metallkunde, vol. 14, no. 1, Jan. 1922, pp. 1-7, 8 figs. Chemical and mechanical properties of aluminum and aluminum alloys and selection of alloys for particular purposes.

ALUMINUM ALLOYS

ALUMINUM-SILICON. New Aluminum-Silicon Alloys, R. E. Search. Metal Industry (N.Y.), vol. 20, no. 5, May 1922, pp. 183-185. Description of "Aladar," "Aludar" and "Silumin". all alloys of aluminum and silicon, and their origin.

PROPERTIES. Properties of Aluminum Alloys. Am. Mach., vol. 56, no. 22, June 1, 1922, pp. 805-806. Why these alloys make good castings; saving in cost shown in relative weights; advantages of melting range, thermal conductivity, rigidity, and shrinkage.

AMMONIA

PRESSURE-TOTAL HEAT DIAGRAM. The Pressure-Total Heat Diagram for Ammonia. H. J. Macintire and G. H. Bohn. Ice & Refrigeration, vol. 62, no. 5, May 1922, pp. 392-394, 2 figs. Simple graphical representation of properties of saturated and superheated ammonia, based upon Bur. of Standards and Goodenough Mosher data, illustrating various refrigeration cycles, etc.

SYNTHETIC. The Haber Process (Procédé Haber), Ma Patart. Memoires et Comptes Rendus des travaux de la Société des Ingénieurs Civils de France, no. 7, Apr. 7, 1922, pp. 156-165. General description of Haber process for manufacture of Ammonia by combining nitrogen from air with hydrogen from water; cost of production; relative and intrinsic value of process.

AMMONIA COMPRESSORS

COMPOUND. Compound Ammonia Compression, G. A. Horne, A.S.R.E. Jl., vol. 8, no. 6, May 1922, pp. 455-487, 3 figs. Methods of intercooling. Cylinder ratios for compound ammonia compression. Horsepower curves.

CYLINDER DESIGN. Compressor Cylinder Design, J. H. H. Voss. Refrig. World, vol. 57, no. 5, May 1922, pp. 11-15, 11 figs. Importance of providing effective valve area in order to prevent waste of power through excess cylinder pressure. Table for calculating correct valve area.

VALVES FOR HIGH-SPEED Valves for High-Speed Ammonia Compressors, J H H. Van Loosen, vol 57, no 16, Apr 18, 1922 pp. 619-621, 8 figs Summarizes desirable points of construction that should be incorporated in design of every light plate valve it used on ammonia compressors.

ANEMOMETERS

THERMOMETRIC The Thermometric Anemometer, J S G Thomas Lond, Edinburgh & Dublin Philosophical Mag, vol 43, no 256, Apr 1922, pp 688-698, 3 figs Calibration curves of low-capacity anemometer of thermometric type for velocities of a few cm. per sec and upwards, and variations caused by heat losses due to conduction and radiation

APPRENTICES, TRAINING OF

SYSTEMS Trends in Management, William Leavitt Stoddard Factory, vol 28, no. 5, May 1922, pp 528 529, 548 and 550, 2 figs Deals with apprenticeship plan, and describes certain systems in the United States.

ASBESTOS

FIRE PREVENTION The Part Asbestos Plays in Fire Prevention, Maurice J Hoover. Fire & Water Eng, vol 71, no 20, May 17, 1922, pp 899-900, 905 and materials which can be used for building purposes; advantages of asbestos for roof covering importance of interior fireproofing

QUEBEC Asbestos Mining and Milling in Quebec, Walter A. RuKeyser Eng & Min Jl -Press, vol 113, nos 15 and 16, Apr. 15 and 22, 1922, pp. 617-625 and 670-677, 19 figs. Apr. 15: Understanding of local geology and essential aid to proper working of deposits; more efficient methods being introduced. Apr. 22: Simple crushing, screening and suction used to separate and grade asbestos

ASH HANDLING

PLANTS. Pneumatic Ash Handling Plant (Pneumatische Entaschungsanlagen), Philippi Archiv fur Warmewirtschaft, vol 3, no 4, Apr 1922, pp. 63-66, 9 figs. Details of construction of small and large plants and advantages of pneumatic conveying

SLUICING AND PUMPING Pumping Ashes Eng & Indus Management, vol. 7, no 15, June 1, 1922, pp 181-182, 1 fig Sluicing process for removal of ashes.

ATOMS

ISOTOPY Recent Results of the Investigation of the Atom (Neuere Ergebnisse der Atomforschung), Karl Przibram Elektrotechnik u Maschinenbau, vol 40, no. 18, Apr. 30, 1922, pp. 205-210, 2 figs. Discusses question of isotopy of certain elements which, in spite of different radioactive behavior and different atomic weights, show exactly same chemical properties

AUTOMOBILE ENGINES

CAMS AND POPPET VALVES Experiments on Cams and Poppet Valves, G E Scholes, Automobile Engr, vol 12, no 163, May 1922, pp 151-157, 16 figs Introduces formulas and charts Paper read before Inst Automobile Engrs.

CRANKSHAFTS, MACHINING Machining a Case Hardened Mack Crankshaft, Fred H. Colvin. Am. Mach., vol. 56, no 16, Apr 20, 1922, pp 585-587, 9 figs. Hard and long-wearing surfaces secured by case hardening. Straightening, turning and grinding operations; balancing, final straightening and inspection.

IGNITION Automobile Ignition, Chas Baxter Engineering, vol 113, no 2941, May 12, 1922, pp. 578-579, 10 figs. Investigation with view to bringing out relative methods of magneto and coil for battery systems.

AUTOMOBILE FUELS

ALCOHOL Alcohol Motor Fuel Research. Motor Transport, vol 34, no 898, May 15, 1922, pp 600-601 6 figs Encouraging interim report issued by Empire Motor Fuels Committee of Imperial Motor Transport Council

AUTOMOBILE INDUSTRY

RENAULT WORKS, FRANCE The Works of the Société Anonyme Renault. Engineering, vol 113, no 2943, May 26, 1922, pp 639-643, 11 figs Description of 640,000-sq yd plant which manufactures own iron and steel castings, rolls metal to their own dimensions; develops 15,000 b.hp

AUTOMOBILES

AXLES, REAR. A Dual Reduction Rear Axle, Fred H. Colvin. Am. Mach., vol. 56, no 18, May 4, 1922, pp. 663-665, 12 figs. Cutting-off, drilling, boring and milling methods on a forged axle. Fixtures which facilitate easy handling.

BRAKE COUPLINGS Are Cables Superior to Rods for Brake Couplings? M W. Bourdon. Automotive Industries, vol 46 no 20, May 18, 1922, pp 1059-1060, 8 figs. European makers claim cables stronger. Sunbeam, Minerva, Ansaldo, Lorraine-Dietrich, and La Licorice furnish some excellent examples of current practice

STARTER ARMATURE. Novel Starter Amature Eliminates Use of Soldered Commutator Joint. Automotive Industries, vol. 46, no. 21, May 25, 1922, p. 1108, 2 figs Closed end of armature coil located at what is usually commutator end. Separate commutator dispensed with Two armature bearings are placed close together Simplified construction greatly reduces production cost

SUSPENSION DESIGN The Design of Motor Car Suspensions, A A Remington, Automobile Engr., vol. 12, no. 163, May 1922, pp 139-141, 2 figs Consideration of factors involved and some conclusions.

SUSPENSION SPRINGS European Makers Adopt Quarter Elliptic Springs for Light Cars M W Bourdon Automotive Industries vol 46, no 22, June 1, 1922, pp. 1153 1157, 18 figs Modifications in original application have been found necessary in practice. Standard and Wolseley offer good examples of "safety leaf". Carrow shows use of radius rod in construction.

AVIATION

AIR PORTS, ORGANIZATION OF The Organization of Airports Aviation, vol 12, no. 23, June 5, 1922, pp. 660-662, 4 figs. Information division, air service issues revised specifications and rules for ground organization.

B

BEAMS

CALCULATION Expansion of the Clapeyron Equation (Erweiterung der Clapeyronschen Gleichung), Edgar Schmidt Eisenbau, vol 13, no 4, Apr 21, 1922, pp 71 77, 7 figs Assumes statically indeterminate main systems for derivation of the equation to simplify work of calculating beams with n supports

DEFLECTION Some Problems in Deflection of Beams, Ewart S. Andrews Concrete & Constructional Eng., vol 17, no 4, Apr. 1922, pp 235-243, 4 figs Gives derivation of formulas for deflection of beams for two cases not usually dealt with in text books.

BELTING

LEATHER. Power Transmission by Belting, P. F O'Shea Machy (N. Y.), vol. 28, no 10, June 1922, pp 814-816, 4 figs Characteristics of leather belting and charts for simplifying calculations

LEATHER, LABORATORY TESTS. Method of Tests on Leather Belt and Laboratory Equipment, L. W. Arny. Belting, vol 20, no 5, May 1922, pp 31-32, 2 figs How research into many perplexing problems is conducted by leather belting exchange foundation at Sibley College of Mech. Eng, Cornell.

STEEL. Machinery Driven by Steel Belt, John D. Knox. Iron Trade Rev., vol. 70, no 16, Apr 20, 1922, pp 1114-1116, 6 figs. Endless steel bans rolled from seamless tubing have wide application for transmitting power; slippage is overcome by facing pulleys with cork; relation of pulley speeds is discussed.

BLAST-FURNACE GAS

CLEANING METHODS, COMPARISON Gas Cleaning Methods Compared, N. H. Gellert. Iron Trade Rev., vol 70, no 20, May 18, 1922, pp 1401-1406, 4 figs. Analysis of relative merits of dry and wet cleaning systems with formulas and tabular data supplying specific information; concludes that hot cleaned gas effects a fuel economy

VALUE OF CLEAN. The Value of Clean Blast-Furnace Gas, N. H. Gellert Mech. Eng., vol. 44, no. 5, May 1922, pp. 305-310, 3 figs. Savings resulting from use of clean gas in hot-blast stove and boiler operation. Superiority of dry cleaning over wet cleaning. Possibilities held out by electrical cleaning process

WASHING PROCESS. Analyzing Gas Washing Losses, H. T. Watts. Iron Trade Rev., vol 70, no 17, Apr 27, 1922, pp 1179-1181 Causes of heat losses in wet washing of blast furnace gas are outlined and amount of loss is calculated Effects of stoves and vapor content are considered.

BLAST FURNACES

CHARGING. Notes on Blast Furnace Filling, D E Roberts Engineering, vol 113, no. 2941, May 12, 1922, pp 599-603, 16 figs Relative advantages of skip and bucket systems Paper read before Iron & Steel Inst

FILLING Notes on Bast-Furnace Filling, D E Roberts Iron & Steel Inst advance paper no 9, meeting May 1922, 17 pp, 14 figs partly on supp plates Description of skip and bucket methods of mechanical charging

LINING FAILURES Lining Failures Caused by Zinc, P O Menke. Iron Trade Rev, vol 70, no 20, May 18, 1922, pp 1409-1410 This element in ores and limestone causes deterioration, effect is accumulative; water cooling above mantle seems to accelerate action, recommends heavier plates

REMODELING. Rebuilds Eastern Blast Furnace, Richard Peters, Jr Iron Trade Rev., vol. 70, no. 18, May 4, 1922, pp. 1258-1260, 4 figs. Thomas Iron Co in modernizing historic plant at Hockendauqua, Pa. completely reconstructs stack no. 3; new equipment includes buildings, power plant and auxiliary apparatus; provision is made for future expansion.

BOILER FEEDWATER

CHARACTERISTICS. The Story of Feed Water, M F Newman Combustion, vol. 6, no. 6, June 1922, pp 275-278, 5 figs Impurities which cause trouble and suggested plan for feedwater.

HEATING. Heating Feedwater by Steam From Turbines (Réchauffage de l'eau d'alimentation par prélèvement de vapeur aux turbines), R. de Kergaradec. Génie Civil; vol. 80, no. 17, Apr. 29, 1922, pp. 380-383, 2 figs. Makes calculations of savings effected; draws attention to some modifications required in boiler equipment.

BOILER FIRING

OIL FIRING SYSTEM The New Korting Oil Firing System (Neue Korting-Oelfeuerungen), Pradel Petroleum, vol 18, no 13, May 1, 1922, pp 481-486, 8 figs Describes new steam jet or compressed air centrifugal atomizer recently put on market, and gives examples of its application.

OIL-FUELED Oil Firing Sixty-four Boilers at Amoskeag Power, vol 55, no 24, June 13, 1922 pp 920-923, 5 figs Features of installation at Manchester, N.H., which eliminates factors of coal firing objectionable in textile plant.

BOILER MAKING

BABCOCK & WILCOX FRENCH PLANT The Works of the French Babcock & Wilcox Co., Engineering, vol. 113, no. 2944, June 2, 1922, pp. 674-676, 7 figs. Description of plant covering 153,000 sq. yd. and containing 8 large buildings in which all operations are carried on.

BOILER OPERATION

COLFAX STATION. Boiler-Room Performance and Practice of the Colfax Station. Duquesne Light Company, C. W. E. Clarke. Mech. Eng., vol. 44, no. 5, May 1922, pp. 295-300, 8 figs. Description of plant of Duquesne Light Co., Cheswick Pa, and some details of its operation and performance.

EFFICIENCY. New Practical Industrial Method of Using Boilers (Nouvelle méthode industrielle pratique pour l'exploitation rationnelle des générateurs de vapeur), H. Carra. Chaleur & Industrie, vol. 3, nos. 23 and 24, Mar. and Apr. 1922, pp. 1049-1056 and 1158-1164, 9 figs. Discusses essentials of combustion and analysis of losses in heat production, measurement and control of these losses, leading to quasi-automatic control.

BOILER PLANTS

PRODUCTION COST. Production Costs and Boiler Plants, W S Johnston. Combustion, vol. 6, no. 6, June 1922, pp. 285-288. General discussion of expenses with suggestions for plant enlargements or renewals as deduced from modern achievements

BOILER PLATES

CRACKS. Formation of Cracks in Boiler Plates, B. Strauss and Ad. Fry. Forging & Heat Treating, vol. 8, no 5, May 1922, pp. 225-229, 23 figs. Force influence figures developed by new etching method permit recognition of brittleness. Tests show that rolled-plates should be finished at as high a temperature as possible. Translated from "Stahl und Eisen" Aug. 18, 1921.

BOILER TUBES

CHARCOAL IRON. Installing and Maintaining Charcoal Iron Locomotive Boiler Tubes, C H. Woodroffe and C E Lester Ry Mech Engr, vol. 96, no. 5, May 1922, pp 274-278, 13 figs Use of welding in tube work, with particular reference to recommended maintenance practice in enginehouses. Describes effective flue shop equipment and lay-out.

BOILERS

Centralized Combustion Control. Centralized Combustion Control for Boilers. Power, vol. 55, no. 20, May 16, 1922, pp. 771-774, 8 figs. Operation of automatic control for bank of boilers thereby maintaining constant character of combustion at all loads.

Developments. Recent Boiler Developments, V. Z. Caracristi. Steam, vol. 29, no. 5, May 1922, pp. 123-128. [illegible] pressure and output by recent development, covers [illegible] power.

Seams, Efficiency of. Calculating the Efficiency of Boiler Seams, R. J. [illegible]. Boiler Maker, vol. 22, no. 5, May 1922, pp. [illegible]. [illegible] to reduce chance for error and facilitate work; points where failure is likely to occur.

Steam Heating. Water returns to Steam Heating Boilers. Am. Soc. Heating & Vent. Engrs. Jl., vol. 28, no. 3, Apr. 1922, pp. [illegible], 1 fig. Proper return connections to heating boilers when set [illegible] application of check valves. Report prepared by representatives of engineering staffs of insurance companies writing steam-boiler insurance in United States.

BOILERS, WATER-TUBE

Spearing. Spearing Water-Tube Boiler, Elec. Rev., vol. 90, no.2320, May 12, 1922, pp. 652-655. 6 figs. Characteristics including sectional headers, downcomer pipes, reservoir mud drum.

BRASS

Corrosion and Dezincing. Selective Corrosion and Dezincing of Brass Parts (Selektive Korrosionen und Entzinkungerscheinungen an Messingteilen), F. V. Wurstemberger. Zeit für Metallkunde, vol. 14, nos. 1 and 2, Jan. and Feb. 1922, pp. 23-29 and 59-69, 26 figs. Explains dezincing as a double process of an anodic dissolution of metal and a cathodic precipitation of copper; elimination of corrosion.

Forged or Hot-Pressed. Making Hot-Pressed or Forged Brass, L. S. Love. Iron Age, vol. 109, no. 23, June 2, 1922, pp. 1581-1583, 3 figs. Advantages of percussion power press; application to bronze, nickel, tin and aluminum; details of process.

BRIDGE DESIGN

Skew Barrel Arch. Thrust of Skew Barrel Arch Measured on Laboratory Model, Clyde T. Morris. Eng. News-Rec. vol. 88, no. 16, Apr. 20, 1922, pp. 638-640, 5 fig. Results showing concentration of thrust at one corner of abutment indicate that common method of stress calculation is in error. Field tests to be made on Scioto River bridges.

BRIDGES

Arched, Expansion and Contraction in. Calculation of Expansion and Contraction in Arched Bridges (Beitrag zur Berechnung der Warmespannungen in Gewölbten Brücken), Rudolf Kern. Bauingenieur, vol. 3, no. 8, Apr. 30, 1922, pp. 239-244, 5 figs. Discusses effect of temperature changes and expresses them mechanically.

Concrete Substructures. Concrete in Bridge Substructures, Concrete & Constructional Eng., vol. 17, no. 5, May 1922, pp. 310-315, 11 figs. Description of Johnson St. Bridge, Victoria, B.C., consisting of two independent "Strauss" Bascule spans constructed side by side upon common substructure.

Iron, Rust Prevention. Rust Formation and Prevention in Iron Bridges (Rostbildung und Rostverhütung bei eisernen Brücken), Paul Hoffman. Zentralblatt der Bauverwaltung, vol. 42, nos. 31, 32, 33 and 34, Apr. 15, 19, 22 and 26, 1922, pp. 183-184, 189-192, 196-198, and 203-206, 22 figs. Apr. 15: Discusses formation of rust and influence of coatings of dust in aggravating corrosion. Apr. 19: Deleterious effect of locomotive flue gases; various examples of corrosion. Apr. 22: Direct and indirect means for preventing formation of rust. Apr. 26: Importance of preparing metallic surfaces before applying paints, by sand blast or chemical means, application of tar colors, metal and concrete coatings.

BRIDGES, HIGHWAY

Batiscan River, Que. New Highway Bridge Over Batiscan River, Que., Edward Holgate. Can. Engr., vol. 42, no. 20, May 16, 1922, pp. 487-489, 5 figs. Important link completed in Montreal; Quebec highway; 6 fixed spans of 189 ft. and 62-ft. bascule span; pile foundation on soft clay; great care in computing counterbalancing; easy operation of bascule.

Gunite-Encased-Steel. Large Steel Arch Bridge Ribs, Encased in Gunite, C. B. McCullough. Eng. News-Rec., vol. 88, no. 29, June 8, 1922, pp. 942-945, 6 figs. Oregon highway bridge has central span of 350 ft. made up of structural steel with thin concrete covering; comparison of alternate designs considered.

BRIDGES, RAILWAY

Specifications. Tentative Specifications for Steel Railway Bridges. Am. Soc. Civil Engrs. Proc., vol. 48, no. 4, Apr. 1922, pp. 572-657, 28 figs. Discussion on design developing formulas bringing out valuable facts on this subject.

Steel Arch. Erection of Hurricane Gulch Arch Bridge on Alaska Government Railway. Ry. Rev., vol. 70, no. 18, May 6, 1922, pp. 638-640, 3 figs. Describes steel arch bridge, 300 ft. high completed over Hurricane Gulch, 284 miles north of Seward; span of arch, 384 ft., contains nearly 1,000 tons of steel, besides 530 tons that were required for approaches.

Substructure, Wabash Rouge River. The Substructure of the Wabash Rouge River at Detroit, Mich., S. M. Smith, Armour Engr., vol. 13, no. 4, May 1922, pp. 250-255, 5 figs. Description of substructure of trunnion bascule type of bridge having 90-ft. span.

BRONZES

Manganese. Occurrence of Blue Constituent in High-strength Manganese Bronze, E. H. Dix, Jr. Trans. Amer. Inst. Min. & Met. Engrs. issued with Min. & Metallurgy, May 1922, no. 1158-N, 16 pp., 19 figs. Study of this feature discovered during investigation of high-strength manganese bronze by Eng. Division of Air Service.

Manganese, Engineering Uses. Manganese Bronze in Engineering Work. Iron Age, vol. 109, no. 22, June 1, 1922, pp. 1513-1515, 5 figs. How it is made in large foundry; its properties in castings and rolled form; typical installations.

BUILDING CONSTRUCTION

Piers, Load Tests. Load Tests of Piers for Chicago, New Union Station. Eng. News-Rec., vol. 88, no. 20, May 18, 1922, pp. 822-824, 4 figs. Jacking load of 87½ tons per sq. ft. gives little compression of hardpan; skin friction of pier in clay.

C

CABLES, ELECTRIC

Lead-Covered, Corrosion of. The Corrosion of Lead-Covered Wiring by Oak, P. Dunsheath. Elec. Rev., vol. 90, no. 2, 321, May 19, 1922, pp. 690-691, 3 figs. Some interesting facts on corrosive effect of oak on lead-covered wire.

Underground Construction. Factors in Reducing Coats in Underground Construction Work. Jl. Elec. & West. Industry, vol. 48, no. 10, May 15, 1922, pp. 414-417, 1 fig. Western Power Co. practice in use of underground cables under local climatic conditions, with discussion of possibilities of cost reduction in underground and submarine cable installations.

CALCULATING MACHINES

Mercedes-Euclid. A Machine That Thinks (Mitteilungen aus der Praxis). Technische Blätter, vol. 12, no. 20, May 20, 1922, pp. 204-206, 3 figs. Describes Mercedes-Euclid arithmetical machine and gives details of its operations in adding, subtracting and multiplication.

CAR WHEELS

Cast-Iron. Metal for Cast Iron Car Wheels, Y. A. Dyer. Iron Age, vol. 109, no. 22, June 1, 1922, pp. 1504-1506. Three distinct compositions embodied in one mass; white, gray and mottled; care necessary in blending cupola charges.

Chilled-Iron. An Investigation of the Properties of Chilled Iron Car Wheels, J. M. Snodgrass and F. H. Guldner. Univ. Ill. Bul. no. 129, vol. 19, May 1, 1922, pp. 9-95, 44 figs. Requirements of car wheels and tests of this type.

Thermal Stresses in Chilled Iron Car Wheels, G. K. Burgess and R. W. Woodward. Technologic Papers of Bur. of Standards, no. 209, Mar. 18, 1922, pp. 193-226, 26 figs. Stresses calculated from strain-gage measurements.

Tire Rolling. A New Departure in Type Rolling Ry. Gaz., vol. 36, no. 18, May 5, 1922, pp. 735-736, 6 figs. Describes system for production of railway tires which has recently been installed by leading firm of manufacturers.

CARS, FREIGHT

Corrugated Steel Roof. A Self-Supporting Corrugated Steel Freight Car Roof. Ry. Age, vol. 72, no. 19, May 13, 1922, pp. 1129-1130, 2 figs. Describing new design placed on market by Sharon Pressed-Steel Company.

CASE-HARDENING

Carburizing. Recommended Practice in Carburizing. S. P. Rockwell. Am. Mach. vol. 56, no. 22, June 1, 1922, pp. 811-812. Suggestions for selection of carburizing material; methods of testing it; best materials for different kinds of works; design and use of carburizing pots. Paper read before Am. Gear Mfrs. Assn.

Penetrability of Carbon. The Penetration of Carbon into Metals and Mixed Crystals of Iron (Ueber die Diffusion des Kohlenstoffs in Metalle und die Mischkristalle des Eisens), Gustav Tammann. Stahl u. 9 figs. Coefficient of penetrability of carbon and effect of molybdenum, cobalt, manganese, tungsten, etc., on depth of penetration.

CAST IRON

Carburization. A Study of Carburization in Manufacture of Synthetic Cast Iron, C. E. Williams and C. E. Sims. Amer. Electrochem. Soc. advance paper, no. 13, meeting Apr. 27-29, 1922, 8 figs. Investigation of factors which influence carburization.

Chemical Composition. Cast Iron and Its Chemical Composition, O. Smalley. Foundry Trade Jl., vol. 25, nos. 298 and 299, May 4 and May 11, 1922, pp. 323-326, and 343-345, 16 figs. Study of little known elements in cast iron which have kept mechanical characteristics from being controlled. Paper read before Inst. of British Foundrymen.

Electrical Melting. Melts Gray Iron Electrically, W. E. Cahill. Foundry, vol. 50, no. 10, May 15, 1922, pp. 420-421. Cheap current makes it profitable to melt both iron and steel for castings electrically; power consumption figures given; iron produced has uniformly fine grain.

Synthetic, Carburization of. Carburize Synthetic Cast Iron, Clyde E. Williams and C. F. Sims. Foundry, vol. 50, no. 10, May 15, 1922, pp. 390-393 and 422, 8 figs. Experiments made in introducing commercial forms of carbon; details of operation and results; effects of slags and various elements contained in iron are studied.

CASTING

Continuous. Improving Casting Methods in Steel Works (Amélioration des procédés de coulée dans une aciérie), Lucien Dujardin. Outillage, Tome 256, no. 16, Apr. 1922, pp. 475-477, 6 figs. Discusses continuous casting in order to increase production, and describes foundry arrangements necessary.

CASTINGS

Centrifugal. Producing Centrifugal Castings, Leon Cammen. Iron Trade Rev., vol. 70, no. 17, Apr. 27, 1922, pp. 1188-1193, 3 figs. Methods of making hollow metal objects and machine used is described. Uniform cooling of poured metal makes manufacture of thin tubes possible; believes process may be applied to plate making. Presented at A.S.M.E. Spring Meeting May 1922.

CATALYSIS

Contact. Contact Catalysis, Wilder D. Bancroft. Engrs.' Soc. West. Pa. Proc., vol. 37, no. 8, Nov. 1921, pp. 375-389 and (discussion) 390-397. Notes on contact sulphuric-acid, Haber ammonia Ostwald nitric-acid, and Sabatier hydrogenation process. Future developments.

CEMENT

Alumina. Alumina Cement; Its Development, Use and Manufacture, Henry S. Spackman. Eng. News-Rec., vol. 88, no. 20, May 18, 1922, pp. 831-834. History and properties of high strength, quick setting cement now being produced commercially in France.

"Cement Fondu'. — Alumina Cement, M. R. Alavene. Concrete, vol. 20, no. 4, Apr. 1922, pp. 73-75. Obtained by fusing in appropriate furnace a mixture of limestone or lime and bauxite; composed of silica, alumina, iron and iron oxide, and lime; rapid hardening allows early use, absolutely unaffected by sulphurous and sea waters. (Abstract.) Science et Industrie, Nov. 3, 1921.

CEMENT MANUFACTURE

Clinker Burning. Heat Distribution in Burning Cement Clinker, Elliott H. Whitlock and Charles E. Burgoon. Concrete, vol. 20, no. 5, May 1922, pp. 111-118, 14 figs. Study of [illegible] conditions with view to improving efficiency of operation from engineering standpoint.

SEGREGATION. Segregation, Charles Catlett. Concrete, vol. 20, no. 5, May 1922, pp. 119-124. Results of original investigation and segregation as applied to cement industry.

CENTRAL STATIONS

CALUMET, CHICAGO. Calumet Station, Commonwealth Edison Co. Power, vol. 55, no. 22, May 30, 1922, pp. 842-850, 10 figs. Initial installation, 60,000 kw. Steam supplied to turbines at 300 lb. pressure and 200 deg. superheat. Seven 15,089 sq. ft. boilers designed for 350 lb. and 250 deg. superheat. Other features of installation.

ECONOMIC OPERATION. Economic Production of Power and the Technical Side of Super-Central Stations. (La production économique de l'énergie et la technique des super-stations centrales), A.-R. Garnier. Technique Moderne, vol. 14, nos. 2, 3 and 4, Feb., Mar. and Apr. 1922, pp. 63-69, 106-112 and 167-170, 9 figs. Feb.: Modern tendencies in mass production of power, including steam driving of turbines, superheat, handling of fuel, air preheating. Mar.: Technical aspects of superpower stations, including simplification of conduits, increase in power per unit, turbines and their characteristics. Apr.: Discusses electrical equipment, especially close connection between turbine and generator.

LIGNITE — FIRED, GERMANY. Golpa Plant Dry Dredges Lignite and Operates Central Power Station, Geo. F. Zimmer, Coal Age, vol. 21, no. 22, June 1922, pp. 913-919, 13 figs. Brown lignite averaging 40 ft. in thickness but half water, mined by removing 60 ft. of overburden with bucket excavator; central power plant uses 7,000 tons of coal daily.

OPERATION. Performance of Equipment and Trends in Station Practice. Elec. World, vol. 79, no. 20, May 20, 1922, pp. 1033-1035, 1 fig. Analysis of turbine outages and operating data for powdered fuel, Diesel and oil plants constitute important part of report of N.E.L.A. Com. on Prime Movers this year.

CHARTS

CONSTRUCTION. Principles of Constructing Charts (Coup d'œil sur les principes fondamentaux de la nomographie), M. d'Ocagne. Revue Générale des Sciences, vol. 33, no. 8, Apr. 30, 1922, pp. 230-239, 9 figs. Discusses cases in which more than three variables can be reduced to graphic presentation on a plane.

CHROMIUM STEEL

SPONTANEOUS PASSIVITY. Spontaneous Passivity of Chromium Steels (Die spontane Passivität der Chromstähle), G. Tammann. Stahl u. Eisen, vol. 42, no. 15, Apr. 13, 1922, pp. 577-578, 1 fig. Behavior of chromium steels and electrolytes and protective effect of chromium.

COAL

ANALYSIS FOR COKE-OVENS. Analysis of Coal in Coke-Oven Practice, J. Bradwell. Iron & Coal Trades Rev., vol. 104, no. 2822, Mar. 31, 1922, p. 452. Examination as to whether more recent methods of obtaining information regarding constitution of coal substances could be usefully employed as routine tests of quality of coal charged into coke ovens. Methods used at Nunnery colliery. (Abstract.) Address before Coke-Oven Mgrs.' Assn.

COMBUSTION. The Combustion of South African Coals in Boiler Furnaces, E. P. Reim. So. African Eng., vol. 33, nos. 3 and 4, Mar. 31 and Apr. 29, 1922, pp. 40, 73-75. Mar. 31: Origin and mode of formation of coal; impurities. Apr. 29: Describes combustion characteristics. From paper read before Chem. Matallurgical Min. Soc. of So. Africa.

SPONTANEOUS COMBUSTION. Microscopical Examination of Batt, James Lomax. Colliery Guardian, vol. 123, no. 3190, Apr. 21, 1922, pp. 975-977 (includes discussion), 21 figs. Microscopical research carried on for describing the various forms of pyrites of iron disulphide found in coal, its origin and probable effects in relation to spontaneous combustion. Paper read before Manchester Geological & Min. Soc. See also Iron & Coal Trades Rev., vol. 104, no. 2825, Apr. 21, 1922, pp. 577-578.

Spontaneous Combustion of Coal in Mines. Colliery Guardian, vol. 123, no. 3199, Apr. 21, 1922, pp. 977-979. Further discussion by South Staffordshire and Warwickshire Inst. Min. Engrs. of paper presented by S. L. Thacker. South Staffordshire's inmunity from explosions; regulations and preventions; influence of pyrites and fusain; cementationp rocess, etc.

COAL GAS

MANUFACTURE. Coal Gas Manufacture, Jerome J. Morgan. Forging & Heat Treating, vol. 8, no. 5, May 1922, pp. 239-243, 3 figs. Advantages of vertical retorts. Reasons for ascendancy of water gas; present trend of industry.

COAL HANDLING

CONVEYOR, SHAKING. Horizontal Reciprocating Conveyor and Screen on a New Principle, Alphonse F. Brosky. Eng. & Indus. Management, vol. 7, no. 13, May 4, 1922, pp. 407-410, 10 figs. This device is manipulated by revolving weights and spring supports whereby compound motion is obtained and coal [illegible] forward continuously. By duplicating opposing parts use-[illegible] prevented.

CONVEYORS. Tells How Conveyor saved Money for Plant, A. MacLean. Black Diamond, vol. 68, no. 18, May 6, 1922, p. 429, 1 fig. Description of Barber-Greene Conveyor which operated for five years without requiring repairs and handles coal and ashes at thirteen cents a ton, including labor.

[illegible] Devices [illegible] Elevator Company [illegible] the Victoria and Albert Docks, Geo. F. Zimmer, Eng. & Indus. Management, vol. 7, no. 14, May 18, 1922, pp. 435-440, 7 figs. Description of machines designed by Suisted Elevator Co. and ultimate successful accomplishment.

POWER. Handling Coal by Power, James B. Hayden. Combustion, vol. 6, no. 6, June [illegible] for planning same.

COAL MINES

[illegible] Fans, E. Seymour Wood. Instn. Min. Engrs. Trans., vol. 63, part 1, Mar. 1922, [illegible] data for further study of subject.

PNEUMATIC [illegible] Hoadley Tingley. Compressed Air Mag., vol. 27, no. 5, May 1922, pp. 141-145, 10 figs. Review of modern developments brought about by introduction of mining machinery. Some most efficient air-driven machines enumerated and [illegible]

COKE

BLAST FURNACE AND FOUNDRY. Testing of Coke for Blast Furnace and Foundry Purposes (Vorschläge zur Prüfung des Kokses für Hochofen-und Giessereizwecke), Heinrich Koppers. Stahl u. Eisen, vol. 42, no. 15, Apr. 13, 1922, pp. 569-573, 4 figs. Properties of metallurgical coke, ease of combustion, porosity, and different requirements of coke for blast furnaces and foundries.

COKE PLANTS

BY-PRODUCT. Developments in By-Product Coking, A. Thaw. Blast Furnace & Steel Plant, vol. 10, no. 2, Feb. 1922, pp. 122-125, 3 figs. Describes new plant which overcome many difficulties formerly encountered and affords excellent heat economy. Prevention of lime deposits in ammonia stills.

COLUMNS

CONCRETE, FORMS FOR. How to Make Forms for Concrete Buildings, William F. Lockhardt. Concrete, vol. 20, no. 4, Apr. 1922, pp. 164-169, 11 figs. Forms for interior and exterior columns.

COMBUSTION

SPONTANEOUS. Spontaneous Combustion and Friction, Walter L. Wedger. Fire & Water Eng., vol. 71, no. 15, Apr. 12, 1922, pp. 603-604 and 614. Notes on substances subject to spontaneous ignition; coal, fibers and wood charcoal said to be very susceptible; friction fires caused by foreign substances.

AMMONIA. *See Ammonia Compressors.*

CONCRETE

ABRASION TEST. New Laboratory Abrasion Test for Concrete, C. H. Scholer. Cement & Eng. News, vol. 34, no. 4, Apr. 1922, pp. 23-24, 4 figs. Test being developed by Engineering Experiment Station of Kansas State Agricultural College, 9-in. spheres of concrete cast and tested after proper aging and curing. Tested in standard brick rattler using standard abrasive charge.

CAPILLARY CANALS IN. Capillary Canals in Concrete and the Percolation of Water through them, E. T. Moullin. Concrete & Constructional Eng., vol. 17, no. 4, Apr. 1922, pp. 273-278 and (discussion) pp. 278-280. Notes on nature of internal structure and presence of capillary canals as revealed by microscope: Theory to explain why absorption takes place at decreasing rate, etc. Describes tests carried out three years ago. (Abstract.) Paper read before Concrete Inst.

CENTRAL-PLANT-MIXED. Central-Plant-Mixed Concrete Tested for Safe Haul, James W. Brooks. Contractors' & Engrs.' Monthly, vol. 4, no. 4, Apr. 1922, p. 48. Description of tests made to determine safe maximum length of haul.

FASTENING MACHINERY TO. Fastening Machinery to Concrete, G. H. Radebaugh. Brick & Clay Rec., vol. 60, no. 11, May 30, 1922, pp. 848-851, 12 figs. Practices which have been found successful in working with hard concrete; procedure outlined step by step.

LUMBER. Development of Concrete Lumber. Concrete Products, vol. 22, no. 5, May 1922, pp. 61-63, 4 fig. Description of Hahn system and new factory for turning out its units.

CONCRETE CONSTRUCTION, REINFORCED

FORMS. How to Make Forms for Concrete Buildings — Beams and Girders, William F. Lockhardt. Concrete, vol. 20, no. 5, May 1922, pp. 191-197, 13 figs. Valuable information for designing forms used in this type of construction.

CONDENSERS, ELECTRIC

SHORT WAVES, THEORY OF ACTION. The Theory of Action of the "Short Wave" Condenser, F. Addey, Elec. Rev., vol. 90, no. 2, 322, May 26, 1922, pp. 724-725, 5 figs. Explanation not easily obtainable in print.

CONDUITS

CONCRETE. Design and Construction of Novel Concrete Conduit, W. A. Kunick. Eng. & Contracting, vol. 57, no. 15, Apr. 12, 1922, pp. 347-351, 7 figs. Unusual design and cement-gun construction produce economical lowhead conduit. Details, costs and solutions of special problems.

GUNITE SEMI-CIRCULAR. Tacoma Builds Semi-Circular Conduit of Gunite. Eng. News-Rec., vol. 88, no. 22, June 1, 1922, pp. 906-909, 6 figs. Addition to water-supply line for city in Washington has inverted arch of concrete placed with cement gun with precast slab top and gunite cover.

CONVERTERS

SYNCHRONOUS. Voltage Limitations and Flashing of synchronous Converters, J. L. Burnham, Gen. Elec. Rev., vol. 25, no. 6, June, 1922, pp. 348-351, 6 figs. Discussion of technical details of causes of flashovers and remedies for them.

COPPER

ZINC AND USES OF. The Uses of Copper and Zinc, C. T. Van Winkle. Utah Soc. Engrs. Jl., vol. 7, no. 9, Feb. 1922, pp. 167-177. Notes on copper and substitutes; zinc and its applications and uses.

COPPER ALLOYS

CUPRO-NICKEL, COLD-WORK AND RECRYSTALLIZATION. The Internal Mechanism of Cold-Work and Recrystallization in Cupro-Nickel, Frank Adcock. Metal Industry (Lond.), vol. 20, nos. 16 and 17, Apr. 21 and 28, 1922, pp. 372-374 and 392-394, 21 figs. Experiments for gathering information on process of cold-work and recrystallization of metals.

COPPER METALLURGY

COMBINATION WITH PHOSPHOROUS. The Rate of Combination of Copper and Phosphorus at Various Temperatures, C. A. Edwards and A. J. Murphy. Engineering, vol. 113, no. 2944, June 2, 1922, pp. 697-700, 7 figs. Experiments to determine temperature at which rapid combination commences and to follow effect of time on progress of reaction velocity. (Abstract). Paper read before Inst. of Metals.

CORE OVENS

ELECTRIC VS. OIL-FIRED. Core-oven Tests, F. L. Wolf and A. A. Grubb. Am. Inst. Min. & Met. Engrs. Trans. advance paper, no. 1152-N, Apr. 1922, 13 pp. 2 figs.; also (abstract) in Min. & Metallurgy, no. 184, Apr. 1922, pp. 37-38, 2 figs. Describes tests to obtain information regarding costs, efficiency, etc. of baking cores in oil-fired and two electric ovens installed in 1920 in core room of Ohio Brass Co. Power and fuel costs favor oil while quality and uniformity of bake, core losses, convenience and cost of tending favor electricity.

CORROSION

Ferrous Metals. Corrosion of Ferrous Metals, Robert Abbott Hadfield. Engineering, vol. 113, no. 2936, Apr. 7, 1922, p. 419. Preparation of various ferrous metals used in corrosion research of Instn. Civ. Engrs. together with their physical and mechanical properties and general considerations on subject of corrosion. (Abstract). Paper read before (British) Instn. Civ. Engrs.

Prevention by Deactivation of Water. Control of Corrosion by Deactivation of Water, Frank N. Speller. Franklin Inst. Jl., vol. 193, no. 4, Apr. 1922, pp. 515-542, 13 figs. Outline of present status of corrosion prevention by deactivation and deaeration of water.

Sea-Water. Reducing Corrosion by Sea Water, Robt. Hadfield. Iron Trade Rev., vol. 70, no. 21, May 25, 1922, pp. 1481-1483, 3 figs. British conduct extensive investigation to determine best type of steel for under-water structural work; nonrusting steel containing 12 to 14 per cent chromium is found to be most satisfactory.

Water-Carrying Vessels, Prevention. Corrosion and Its Prevention in Vessels Carrying Water, J. R. McDermet. Am. Soc. Heat. & Vent. Engrs., vol. 28, no. 4, May 1922, pp. 407-416. Suggestions for reducing corrosion in water piping, boiler economizers, boilers, steam piping or water tanks.

CRANES

Electric. Electric Cranes At the Swiss, Federal Railway Shops at Bellinzona. Engineering, vol. 113, no. 2943, May 26, 1922, pp. 653-654, 4 figs. Arrangement of two 80-ton electric travelling cranes for handling heavy electric locomotives.

Wharf, Hydraulic. Hydraulic Wharf Cranes. Ship-bldg. & Shipg. Rec., vol. 19, no. 21, May 25, 1922, p. 684, 1 fig. Description of six 30-cwt. luffing cranes for port of London authority.

CUTTING TOOLS

Action of. The Action of Cutting Tools, E. G. Coker and K. C. Chakko. Engineering, vol. 113, no. 2940, May 5, 1922, pp. 564-569, 18 figs. Investigation of most efficient action of various tools for shaping metals and means of determining stresses set up.

Experiments. An Account of Some Experiments on the Action of Cutting Tools, E. G. Coker, Engineer, vol. 133, no. 3462, May 5, 1922, pp. 503-505, 12 figs. Means of studying stress distribution in cutting tools by polarized light.

D

DAMS

Arched. Arched Dams (Etude sur les barrages arqués), A. Stucky. Bul. Technique la Suisse Romande, vol. 48, nos. 1, 3, 4, 8 and 9, Jan. 7, Feb. 4, Mar. 4, Apr. 15 and 29, 1922, pp. 1-7, 25-30, 49-53, 85-90 and 97-103, 28 figs. Jan. 7: American practice; examples for water storage; method of calculation. Feb. 4: Calculation of arcs. Mar. 4: Calculations in connection with Jogne (Gruyère) barrage dam. Apr. 15 and 29: Hydrostatic pressure; temperature variation; calculation of fatigue; profiles of dam walls.

Flood-Control. Flood-Control Dam Replenishes Underground Water Source. Eng. News-Rec., vol. 88, no. 19, May 11, 1922, pp. 770-771, 4 fig. Result of two season's experience with Devil's Gate Dam at Pasadena; flood and water-storage functions conflict.

DETONATION

Study of. The Background of Detonation, Stanwood W. Sparrow. Nat. Advisory Committee for Aeronautics Tech. Notes, no. 93, Apr. 1922, 17 pp., 5 figs. Consideration of several features of detonation problem which it is claimed, have received comparatively little attention.

DIESEL ENGINES

Beardmore-Tosi. The Beardmore-Tosi Marine Diesel Engine. Engineering, vol. 113, no. 2938, April 21, 1922, pp. 488-489, 4 figs. Description of main engines of single-screw motorship Pinzon.

Power Plants. Diesels at Southend. Elec Times, vol. 61, no. 1594, May 4, 1922, pp. 429-430, 3 figs. Rapid increase in demand for electric power met by successive installations of Diesel engines.

Power Plants, Application in. Diesel Engines and Examination into Their Economic Application (Dieselmotoren, Eine Untersuchung über ihre wirtschaftliche Verwendung), Alfred Büchi. Schweizerische Bauzeitung, vol. 79, nos. 18 and 19, May 6 and 13, 1922, pp. 230-235 and 239-243, 11 figs. May 6: Compares hydroelectric with Diesel-electric power generation. May 13: Discusses Diesel engine installation in connection with water power works and gives cost calculation for water power only and water power with Diesel engines.

Submarine Type for Power Plants. Submarine Diesel Engines at Southend, Elec. Rev., vol. 90, no. 2321, May 19, 1922, pp. 688-690, 3 figs. Description of engines taken from dismantled German submarines and generating units which they operate.

Water-Works Power. Diesel Engines to Furnish Power for Water-Works. W. DeWitt Vosbury. Eng. News-Rec., vol. 88, no. 19, May 11, 1922, pp. 793-794, 2 figs. New station at Gloucester, N.J., to be equipped with motorized pumps and high-economy, oil-engine generators.

DYE INDUSTRY

French. The French Dye Industry (L'Industrie Française des matières colorantes), Galopeau. Nature, no. 2506, Apr. 15, 1922, pp. 229-236, 3 figs. State of industry before war and developments during war; reviews principal French works now in operation.

E

ELECTRIC CIRCUITS

Magnetically-Coupled. Chains of Magnetically-Coupled Circuits, E. Bellini. Electrician, vol. 88, no. 2295, May 12, 1922, pp. 560-561. Solving frequencies which occur in cases of 4 and 5 magnetically-coupled circuits. Attempts at solving 6 and 7 circuits.

ELECTRIC COMMUNICATION

Aurora, Effects of. Effects of Aurora on Telegraphs, Telephones and Wireless in New Zealand. Telegraph & Telephone Age, no. 11, June 1, 1922, pp. 248-249. Report by A. Gibbs, deputy chief telegraph engr., on effects of auroral phenomenon generally, and those during exceptionally brillant display.

ELECTRIC DISTRIBUTION

A. C. System. The Development of the Alternating-Current Distribution System, Frank W. Smith. Elec Jl vol 19, no 5, May 1922, pp 209-213, 4 fig. Some facts about alternating current system of the United Elec. Light & Power Co. by its vice-president.

ELECTRIC DRIVES

Installation. Protected Motor Service, T. W. C. Hartmann. Elec. Rev. & Indus. Engr., vol. 80, no. 5, May 1922, pp. 227-228, 257 and 262, 4 figs. Recent installation at Keystone Spring-Works where electric drive has speeded up machine production.

ELECTRIC FURNACES

Carbon Steel. Electric Furnace Practice on Carbon Steel, L. J. Barton. Western Machy. World, vol. 13, nos. 4 and 5, Apr. and May 1922, pp. 134-137 and 173-175, 2 figs. April: Basic Operation; Two-slag practice in production of electric steel, with details of charging, melting down, chemical and other factors. May: Slagging and details of reducing period. Effects of high lime temperature tests. Finishing of heat.

Cast-Iron Production. Cast Iron as Produced in the Electric Furnace and Some of Its Problems, George K. Elliott. Am. Electrochem. Soc. advance paper, no. 9, for meeting Apr. 27-29, 1922, pp. 75-87. Review of literature of electric-furnace cast iron. Discusses conditions favorable to electric furnace, and expresses preference for duplex process with basic-hearth electric furnace. Describes desulphurization and deoxidization; etc.

Electric Furnace Iron and Steel. Intermittent and Alternating Operations, W. E. Cahill. Am. Electrochem. Soc. advance paper, no. 6, for meeting Apr. 27-29, 1922, pp. 49-54. In Treadwell, Alaska, cast iron is made more cheaply in electric furnace than in cupola. Analyses figures show that from charges of all-scrap cupola-melted iron electric furnace produces metal of greatly reduced sulphur content.

Fiat. The Fiat Electric Furnace. Engineering, vol. 113, no. 2936, Apr. 7, 1922, pp. 421-422, 5 figs. partly on p. 424. Three-phase type, having a hearth slightly conductive, neutral and connected to earth. One of characteristic features if the Fiat economizer, or electrode holders.

Non-Ferrous. Metal Electric Furnaces, A. Glynne Lotley. Metal Industry (Lond.) vol. 20, nos. 14 and 15, Apr. 7 and 14, 1922, pp. 322-325 and 343-341 and (Discussion) 341-342, 6 figs. Examples of number of uses for electric furnaces not in iron and steel industry. Portion of report before Sheffield section of Inst. of Metals.

Shaft and Open-Top. A Comparison Between Shaft and Open Top Furnaces in the Manufacture of Pig Iron Electrically from Iron Ore, R. C. Gosrow. Am. Electrochem. Soc., advance paper, no. 8, for meeting Apr. 27-29, 1922, pp. 63-74. Notes on stack and open-top type of furnace and combination open-stack type.

Types. Electric Furnaces and Electrometallurgy, Recent Patents (Les fours électriques et l'électrométallurgie d'après les brevets récents), L. Jumau, Revue Générale de l'Electricité, vol. 11, nos. 12 and 13, Mar. 25 and Apr. 1, 1922, pp. 436-441 and 463-468, 11 figs. Mar. 25: Describes Foley induction. Greiner resistance, Ferron, Moore, and other furnaces. Apr. 1: Electrodes; electric furnaces used in manufacture of steel and production of oxides of nitrogen.

ELECTRIC GENERATORS

Single-Phase. Theory of Single Phase Generator, G. Shimidzu and K. Ito. Danki Kakkwai Zasshi (Jl. Inst. Elec. Engrs. of Japan), no. 404, Mar. 1922, pp. 199-227, 14 figs. Solution for fundamental equation covering steady phenomena is sought, and instantaneous maximum and effective values of steady short-circuit current are calculated. Explains phenomena caused by short circuit taking place between two line terminals in one, two and three-phase generators. (In Japanese.)

ELECTRIC GENERATORS, A.C.

Queenston, Ont. Building Queenston Generators. Can. Chem. & Metallaurgy, vol. 6, no. 5, May 1922, pp. 105-108, 4 fig. Details of 45,000-Kva, (55,000 hp.), 3-phase, 25-cycle, 12,000-v., a.c. generator of Hydro-electric Power Commission of Ontario, manufactured by Can. Westinghouse Co.

ELECTRIC LAMPS

Manufacture. Siemens Lamp Works at Dalston, Elec. Times, vol. 61, no. 1, 597, May 25, 1922, pp. 507-509, 6 figs. Description of many new and interesting processes. (See also Electrician for, vol. 80, no. 2297 pp. 630-631, 6 figs. and Elec. Rev., vol. 90, no. 2322, May 26, 1922, pp. 727-729, 5 figs.

ELECTRIC LOCOMOTIVES

Condensing Turbine. The Ramsay Condensing Turbine Electric Locomotive. Engineer, vol. 133, no. 3456, Mar. 24, 1922, pp. 328-329, 2 figs. Characteristics of experimental locomotive built by Armstrong, Whitworth & Co., Ltd.: Length overall, 69 ft. 7 in.; max. width. 8 ft. 3 in.; total weight, including 2200 gal. water for cooling purposes and 4 tons coal, 130 tons 15 cwt.; tractive force, 22,000 lb.; turbo-generator, 890 kw., at 3,600 rev., voltage, 600. See also Ry. Rev., vol. 70, no. 19, May 13, 1922, p. 667.

Metropolitan Ry., London. 1,200-Hp. Electric Locomotives for the Metropolitan Railway. Engineering, vol. 113, nos. 2936 and 2938, Apr. 7 and 21, 1922, pp. 409-412 and 477-481, 32 figs, partly on supp. plate. Locomotives are 0-4-4-0 type and each have two bogie trucks of carriage type on which body is carried. Max. speed on non-stop runs is 60 mi. per hr.; electric supply is at 500 to 600 volts on third-rail system, and insulated negative return rail is laid in center of track; motors are of standard series-wound type with commutating poles. Describes control gears

ELECTRIC METERS

Accuracy. Providing for Accuracy in Power Company, Meter Records, W. R. Frampton, Jl. Elec. & West. Industry, vol. 48, no. 10, May 15, 1922, pp. 409-414, 16 figs. Good practice in meter installation and testing, as well as advisable organization of company meter departments discussed in convention report of meter committee of Pacific Coast Electrical Assn.

Phase Meters, Theory of. Some Notes on the Theory of Phase Meters, G. W. Stubbings, Electrician, vol. 88, no. 2296, May 19, 1922, pp. 586-588, 2 figs. Detailed consideration of single- and three-phase meters. Resultant rotating field, pulsating fields, frequency errors, accuracy and factor meters discussed.

ELECTRIC MOTORS

Blowers, for. The Control of Blower Motors, H. G. Issertell, Power Plant Eng., vol. 26, no. 11, June 1, 1922, pp. 573-575, 5 figs. Factors to be considered in selection of motors and type of control for blower service.

[illegible] Motor Installation, Edgar P. [illegible] 1922, pp. 687-689, 3 figs. Table is given [illegible] installation of motors, and some [illegible] table to motor circuits.

ELECTRIC MOTORS, A.C.

COMMUTATOR. Single- and Three-Phase Alternating-Current Commutator Motors [illegible] Instn. Elec. Engrs. [illegible] Mar. 1922, pp. 308-314 and discussion 314-327, 15 figs.

Test-Results Obtained from a Three-Phase Shunt Commutator Motor, [illegible] vol. 60, no. 307, Mar. 1922, pp. 328-338, 34 figs. Tests on motor manufactured by Swedish Elec. Co. operation of motor, [illegible] with symmetrical brush-gear setting, [illegible] gear setting, theory with vector diagrams.

ELECTRIC MOTORS, D.C.

BRAKING, REGENERATIVE AND DYNAMIC. Regenerative and Dynamic Braking with Direct-Current Motors, B. A. Briggs. Power, vol. 55, no. 24, June 13, 1922, pp. 924-925, 6 figs. Explanation of two types of braking and how they are applied to elevator motors.

ELECTRIC PLANTS

INTERCONNECTION OF A.C. The Interconnection of Alternating-Current Power Stations, [illegible] and [illegible] Instn. Elec. Engrs. Jl., vol. 60, no. 307, Mar. 1922, pp. 287-298 and (discussion) 298-303, 9 figs. Special factors governing design of interconnecting link between two a.c. power stations, with particular reference to power factor and power-factor control. Gives equations in [illegible] power factor [illegible] current with any given load and voltage [illegible] types of booster for controlling power factor.

WASTE FUEL UTILIZATION. Electricity from Limburg Waste Fuels (Electriciteitsopwekking uit Limburgsche afvalbrandstoffen), A. J. Ter Linden. Ingenieur, vol. 37, no. 15, Apr. 15, 1922, pp. 282-297, 26 figs. Use of low-grade fuels, brown coals, etc., hand and mechanical stoking, results of tests made.

ELECTRIC RAILWAYS

ELECTROLYSIS AND INDUCTIVE INTERFERENCE. Effects of Electric Power Used for Traction, Chas. [illegible] Ry. Elec. Engr., vol. 13, no. 4, Apr. 1922, pp. 113-116, 1 fig. Question of inductive interference and electrolysis as related to railway [illegible]

ELECTRIC SWITCHES

OIL, D.C. CIRCUITS. The Suitability of Oil Switches for D.C. Circuits, W. Wilson. [illegible] vol. 10, no. 5, May 1922, pp. [illegible]-373, 7 figs. Discussion of construction made necessary by recent increase in D.C. voltage use.

ELECTRIC TRANSMISSION LINES

140-KV. [illegible] Hydro and Steam Plants Joined by 140-Kv. lines in Michigan, Harry J. Burton and William W. Tefft. Elec. World, vol. 79, no. 16, Apr. 22, 1922, pp. 770-773, 5 figs. 1300 mi. of transmission line involved, of which 526 mi. is of above voltage. 11 years' experience justified line construction employed.

PROTECTIVE DEVICES. The Influence of Condenser and Choke Coil Protective Devices on Travelling Electric Waves, S. Austin Stigant. Elec. Times, vol. 61, [illegible] May 11, 18 and 25, 1922, pp. 453-454, 481-482 and 505-506, 12 figs. Study of travelling pressure and current waves as effected by [illegible] coils. (Abstract.) Paper read before Jr. Inst. of Engrs.

224,000 VOLTS. EXPERIMENTS [illegible] with Electrical Transmission at 224,000 volts, H. Michener. Jl. Elec. & Western. Indus. vol. 48, no. 10, May [illegible] [illegible] apparatus as it has stood up under actual operating conditions at 224,000 volts and discussion of equipment [illegible] Pit River and Big Creek Lines when they go into action.

ELECTRIC WELDING, ARC

STRUCTURAL STEEL. Arc Welded Steel Building, B. C. Tracey. Welding Engr., vol. [illegible] labor and material; [illegible]

The Arc Welding of Structural Steel, E. S. Humphrys, Jr. Iron Age, vol. 109, no. 21, May 25, 1922, pp. 1422-1425, 7 figs. Tests made to determine reliability of welded joints and limiting conditions of various types of joints.

UTILITY. Utility Arc Welding. Engineer, vol. 133, no. 3458, Apr. 7, 1922, pp. 378-[illegible]

ELECTRICAL DISTRIBUTION

[illegible] How West Penn [illegible] three-phase with maximum use of old equipment and least interruption of ser-[illegible]

ELECTRICAL MACHINERY

[illegible]

ELECTROLYTES

[illegible] r, no. 11, Meeting Apr. [illegible]

[illegible]

F

FATIGUE

FAILURE BY. Failure By Fatigue. Engineering, vol. 113, no. 2939, April 28, 1922, pp. 525-526. Doubts as to mathematical theory of elasticity; discussion and means of determining fatigue tendencies of material.

FERRONICKEL

BRITTLENESS AT LOW TEMPERATURES. On the Brittleness of Ferronickel at Low Temperatures (Etude de la fragilité des Ferronickels aux basses températures), P. Chevenard. Revue de Métallurgie, vol. 19, no. 4, Apr. 1922, pp. 209-214, 3 figs. Experiments to produce metal which would not become brittle at temperature of liquid air, to be used for accessories of liquid-air machines, and results.

FILTRATION PLANTS

DETROIT. New Filtration Plant for Detroit, Largest in the World. Eng. World, vol. 20, no. 5, May 1922, pp. 269-271, 5 figs. Plans for plant having daily capacity of from 320 to 360 million gallons per day.

FIREBRICK

TESTING. New Methods for Determining Compression Strength and Softening of Firebrick at High Temperatures (Neue Verfahren zur Bestimmung der Druckfestigkeit und Erweichung feuerfester Ziegel bei hohen Temperaturen). Tonindustrie-Zeitung, vol. 46, no. 57, May 16, 1922, pp. 561-563. Reviews present methods and shows that there is as yet no uniform method of testing.

FLOW OF OIL

PIPES. Flow of Oil in Pipes. Lubrication, vol. 8, no. 4, Apr. 1922, pp. 45-48, 1 fig. Investigation of properties of oil and their effects on flow through pipes.

FLUMES

METAL. Design, Construction and Use of Metal Flumes, Julian Hinds. Eng. News-Rec., vol. 88, no. 21, May 25, 1922, pp. 854-861, 11 figs. Semi-circular flumes discussed from standpoint of types, supports, stresses, expansion, end structures and surface coverings.

FORGING

HYDRAULIC BULGING. Hydraulic Bulging and Bending. Machy. (Lond.), vol. 20, nos. 497, 498 and 499, Apr. 6, 13 and 20, 1922, pp. 8-12, 42-45 and 75-77, 43 figs. Apr. 6: Manufacture of gramophone swan necks and horn elbows. Apr. 13: Manufacture of telephone receiver cases. Apr. 20: Tooling for production of motor side lamp.

FOUNDATIONS

BRACING. Caisson Cofferdam Foundation With Special Bracing, T. Kennard Thomson. Eng. News-Rev., vol. 88, no. 22, June 1, 1922, pp. 914-918, 6 figs. Deep cellar substructure in filled ground, First Nat. Bank of Jersey City; Caissons braced by built-up struts during excavation; toe wall holds caissons against sliding; waterproofing.

FOUNDRIES

BLAST METER, USE OF. Use of a Blast Meter in Foundry Practice, Louis L. Vayda. Iron Age, vol. 109, no. 23, June 8, 1922, pp. 1584-1586, 5 figs. Measurement of air blast volume important in cupola control; methods of measurement.

ELECTRICITY IN. Foundry Employs Electricity for Melting and Annealing, Herbert R. Simonds. Iron Trade Rev., vol. 70, no. 22, June 1, 1922, pp. 1567-1570, 8 figs. Description of units employed by Eastern manufacturer shows electrical equipment affects economies.

MOTOR CASTINGS. A New Canadian Motor Foundry Plant. Iron Age, vol. 109, no. 16, Apr. 20, 1922, pp. 1068-1070, 6 figs. How old plant was made into new one, designed with view to future expansion. Machine molding a feature in plant of Hiram Walker & Sons Metal Products Co. Ltd., Walkerville, Ont.

FUEL ECONOMY

FRANCE. Reducing the Cost of Motive Power (Réduction des dépenses de force motrice), Ch. Molette. Outillage, Tome 259, no. 19, May 13, 1922, pp. 604-605. Generally discusses question of efficiency and shows that in nearly all cases a saving of from 10 to 20 per cent can be effected.

N. C. & ST. L. RY. Keen Competition Key to Fuel Economy on N. C. & St. L. Ry., J. B. Hill. Ry. Rev., vol. 70, no. 20, May 20, 1922, pp. 701-705, 7 figs. Rivalry based on individual and divisional fuel performance records improves entire operation of railroad.

WABASH RAILROAD. How the Wabash Railroad is Organized for Fuel Economy, J. B. Hurley. Ry. Rev., vol. 70, no. 20, May 20, 1922, pp. 705-708. Practical supervision, individual performance records and monthly meetings result in large fuel saving.

FUELS

See Automobile Fuels, Coal, Coke, Gasoline, Lignite, Pulverized Coal.

FURNACES

See also Electric Furnaces.

FURNACES, BOILER

AIR PREHEATER. European Preheater for Furnace Air. Power, vol. 55, no. 16, Apr. 18, 1922, pp. 615-616, 3 figs. Describes type of air heater, known as Thermix, manufactured by Emile Prat Daniel, Paris, which is said to be finding extensive employment in Europe.

FURNACES, HOT-AIR

DEVELOPMENTS. Recent Developments in Warm Air Furnace Heating, F. R. Still. Am. Soc. Heat. & Vent. Engrs., vol. 28, no. 4, May 1922, pp. 385-395, 5 figs. Valuable suggestions sponsored by Warm Air Furnace Code Committee including formulas and charts and some facts about circulation stimulators.

FURNACES, METALLURGICAL

LOW-HEAT GAS-FIRED. Furnaces Utilize Low Heat Gases, R. J. Weitlaner. Iron Trade Rev., vol. 70, no. 19, May 11, 1922, pp. 1332-1334, 6 figs. Application of split flame principle and employment of regenerators similar to those used with open-hearths enable German furnaces of recent design to operate efficiently on inferior grade fuels.

G

GAGES

Gage Blocks. Measurement of Precision Standards [illegible] Interferometer Method. Machy. (Lond.), vol. 20, no. [illegible], May [illegible], 1922, [illegible] figs. Checking gage blocks by N. P. L. comparator [illegible] apparatus for testing accuracy of precision [illegible].

Gage-Block Comparator. Comparator for Checking Precision Gage-blocks, Franklin D. Jones. Machy. (N. Y.), vol. 28, no. [illegible], 1922, pp. [illegible], 6 figs. Extremely sensitive mechanical apparatus [illegible] very effective at plant of Pratt & Whitney Co. for testing [illegible] of precision gage blocks.

GASOLINE

Use and Handling. Use and Handling of Gasoline, D. E. [illegible]. Oil News, vol. 10, no. 10, May 20, 1922, pp. 36-38 and 50. Important educational work of Assn. Natural Gasoline Mfrs; new methods now used; prospective developments.

Water in. Determination of Water in Gasoline as Received, Exposed to Atmosphere, to Humid Atmosphere, and Saturated with Water. Air Service Information Circular, vol. 4, no. 320, Mar. 15, 1922, 2 pp., 1 fig. Investigation to ascertain whether sufficient quantities of water can be absorbed by gasoline to cause corrosion, and investigation of several methods for determining water in gasoline.

GEAR CUTTING

Hobbing Spur Gears. Cutting Spur Gears by Hobbing. Machy. (N. Y.), vol. 28, no. 9, May 1922, pp. 716-721, 5 figs. Setting up gear hobbing machines; examples from practice; application of multiple-threaded hobs; cutting small pinions.

Internal Spur. Cutting Internal Spur Gears, F. D. Jones. Machy. (N. Y.), vol. 28, no. 10, June 1922, pp. 776-779, 8 figs. Milling internal gear teeth with formed cutters; generating teeth on gear shaper; use of form-copying gear planer.

Mass Production. Mass Production in Gear-Cutting, Joseph Horner. Engineering, vol. 113, nos. 2935, 2937, 2938, Mar. 31, Apr. 14, Apr. 21, 1922, pp. 379-380, 443-445 and 477, 5 figs. Discusses methods associated with mass production of all kinds of gears, embracing such matters as division of operations between roughing and finishing, mounting of several blanks in series when practicable, and use of multiple cutters.

Turbine Reduction Gears. Turbine Reduction Gearing and its Production, J. H. Melloy. Engineer, vol. 133, no. 3462, May 5, 1922, pp. 495-496, 3 figs. Means of attaining greatest accuracy in cutting, thereby obtaining silence and smooth running. (Abstract.) Read before North-Western Setion of Instn. Mech. Engrs.

GEARS

Bevel. The Assembling of Bevel Gears, Charles H. Logue. Am. Mach., vol. 56, no. 10, Apr. 20, 1922, pp. 580-584, 14 figs. Adjustment of pinion and of gear produce different results. Gears should be cut with allowance for backlash. Bottoming of teeth.

The Gleason System of Bevel Gears, F. W. McMullen and T. M. Durkan. Am. Mach., vol. 56, no. 23, June 8, 1922, pp. 849-853, 8 figs. Quietness in operation, strength and durability considered; limiting undercut; preference for low-pressure angle; pressure causes wear.

The Gleason Works System of Bevel Gears, F. E. McMullen and T. M. Durkan. Machy. (N. Y.), vol 28, no. 10, June 1922, pp. 788-792, 8 figs. Description of Gleason improvement in design of form of tooth consistent with strength and wear.

New System of Bevel Gearing Developed by Recent Research, F. E. McMullen and T. M. Durkan. Automotive Industries, vol. 46, no. 20, May 18, 1922, pp. 1064-1068, 8 figs. Quietest form of tooth consistent with strength and durability. Addendum and dedendum for any pitch varies with ratio; usually different for pinion and gear. Pressure angle depends on number of teeth ratio. Paper read before Am. Gear Mfrs. Assn.

Chattering. Nodal Arrangements of Geared Drives, J. H. Smith. Engineering, vol. 113, nos. 2936 and 2937, Apr. 7 and 14, 1922, pp. 438-440 and 467-469, 1 fig. Results of author's investigation of chattering of gearing. Deals with dynamics of geared drives; dynamically equivalent masses and shafts; equations of motion; effect of tooth form irregularities. Results and general conclusions relating to critical speeds; simplification of geared drives; arranging periodicity of disturbing torques. Paper read before (British) Instn. Nav. Architects.

Comparator for Testing Teeth. Inspecting Gear and Gear Cutters at One Hundred Magnifications, Ralph E. Flanders. Iron Age, vol. 109, no. 17, Apr. 27, 1922, pp. 1137-1138 and 1183, 5 figs. Describes invention for use in connection with Hartness projection comparator for testing gear teeth. (Abstract.) Paper read before Am. Gear Mfrs.' Assn.

Helical. A Chart to Aid the Figuring of Helical Gears, W. C. Stewart. Am. Mach., vol. 56, no. 17, Apr. 27, 1922, pp. 630-633, 12 figs. Relation between elements of helical gears. Method of constructing "spiral" gear protractor. More rapid solution of problems in helical gearing.

Hydraulic Transmission. Recent Types of Hydraulic Transmission Gear. Eng. & Indus. Management, vol. 7, no. 11, Apr. 6, 1922, pp. 323-327, 5 figs. Discusses main requisites of efficient hydraulic gear and describes Williams-Janney, Hele-Shaw, and Constantinesco systems

Production, Estimating. Estimating Modern Gear Production, Gustave E. Spies. Am. Mach., vol. 56, no. 22, June 1, 1922, pp. 799-804, 7 figs. Charts and a slide rule that make estimating easy; use of disk cutters and hobs; extra travel of cutters; examples of estimate sheets.

Spur. Backlash in Hobber Spur Gears. Machy. (Lond.), vol. 20, no. 502, May 11, 1922, pp. 163-165, 5 figs. Amount of backlash recommended to provide for unavoidable inaccuracies in machining and heat-treatment.

Strength and Proportion. Strength and Proportion of Industrial Gears, G. E. Katzenmeyer. Am. Mach., vol. 56, no. 18, May 4, 1922, pp. 666-671, 7 figs. Charts for determining strength of industrial gears. Formulas and symbols used and practical examples.

Teeth, Grinding. Gear Tooth Grinding Process Reduces Heat Treatment Distortion Dangers, Automotive Industries, vol. 46, no 22, June 1, 1922, pp. 1162-1164, 3 figs. Finishing grinding gear teeth after heat treatment big factor in eliminating noise; permits resurfacing gears already finished cut to size and surfacing of gears which have grinding stock.

The Grinding of Gear Teeth and Its Future in the Industry, R. S Drummond. Am. Mach., vol. 56, no. 21, May 25, 1922, pp. 779-781. Application of ground gear teeth in automotive industry; overcoming effects of heat treatment; elimination of noisy gearing by grinding. Paper read before Am. Gear Mfrs. Assn.

See also Reduction Gears.

GLASS

Colorless. Making Colorless Glass in Tank Furnaces. Glass Worker, vol. 41, nos. 31 and 32, Apr. 29 and May 6, 1922, pp. 11, 22 and 23, and p. 27. Discussion [illegible] of eliminating harmful discolorations by members of British Soc. of Glass Technology. From Pottery Gaz. & Trade Rev.

H

HANDLING MATERIALS

German Mechanical Devices. Development of Mechanical Handling Devices in Germany During and Since the War, George Frederick Zimmer. Eng. & Indus. Management, vol. 7, no. 11, Apr. 6, 1922, pp. 334-340, 13 figs. Deals with mechanical handling devices for blast furnaces.

Port Development, and. Material Handling in Its Relationship to Port Development. Engrs. & Eng., vol. 1, no. 3, Mar. 1922, pp. 65-77 and 96. Symposium of following articles: Design of a Port to Take Full Advantage of Mechanical Equipment, by Carroll R. Thompson; What Has Been Done and What We Should Plan to Do, by Fred Jasperson, What Can Be Done with Ship's Gear, S. C. Loveland. Discussion.

See also Ash Handling; Coal Handling.

HARBOUR IMPROVEMENTS

Iceland. Survey of Harbours on the Icelandic Coast, 1917-'21, N. P. Kirk and Th. Krabbe. (In English.) Timarit, vol. 7, no. 2, 1922, pp. 33-40, 21 maps on supp. plates. Reports submitted to Icelandic Government showing necessary improvement to provide sufficient barbour facilities for fishing industries.

HEATING AND VENTILATING

Individual Units. Individual Heating and Ventilating Units, James Mackay. Domestic Eng. (Chicago), vol. 99, nos. 5 and 6, Apr. 29 and May 6, 1922, pp. 189-191 and 231-232, 11 figs. Notes on construction, installation and operation.

HEATING, ELECTRIC

Industrial. Industrial Electric Heating for Factories, Wirt S. Scott. Elec. Jl., vol 19, no. 5, May 1922, pp. 203-208, 8 figs. Pointing out the many possibilities as yet partially or entirely undeveloped.

HEATING, STEAM

Central Stations. Commission for the Utilization of Fuel—4th Report (Commission d'Utilisation du Combustible). Annales des Mines, vol. 1, no. 3, Mar. 1922, pp. 192-256. Gives report of First Sub-committee on actual practice at central steam heating stations, discussing their general character, types of boilers, superheating, economizers, air preheating, feed-water, etc.

HELIUM

Production. The Industrial Production of Helium, S. G. Roberts. Sci. Am., vol. 126, no. 5, May 1922, pp. 308-309, 5 figs. Improvements in past five years toward development of non-explosive airship.

HIGHWAYS

Motor Trucks Loads. What Should be the Weight Limit for Trucks Operating on Highways? Automotive Industries, vol. 46, no. 20, May 18, 1922, pp. 1053-1055. Highway officials suggest ten tons. Committee appointed by Natl. Highway Traffic Assn. set maximum at 14 tons. Expansion of railroads through trucks.

HYDRAULIC TURBINES

High-Speed Runners. Developments in High-Speed Runners for Hydraulic Turbines, Frank H. Rogers. Power, vol. 55, no. 17, Apr. 25, 1922, pp. 640-643, 8 figs. Limitations of Francis type runners; comparison of different types of high-speed propeller runners; location of turbine with respect to tailwater; use of inverted-type and ejector-type turbines in low-head plants.

Mixed-Flow. The American Mixed-Flow Turbine and Its Setting, Arthur T. Safford and Edward Pierce Hamilton. Am. Soc. Civil Engrs. Proc., vol. 48, no. 4, Apr. 1922, pp. 753-808, 34 figs. Review of developments of turbine runner and of water-wheel setting.

Niagara Falls. Three 70,000 h.p. Hydraulic Turbines To Be Installed at Niagara Falls. Power, vol. 55, no. 23, June 6, 1922, pp. 894-895, 4 figs. Largest hydraulic-power tunnel in world to supply water to three largest hydro-electric units designed up to this time; these machines will operate under 215-ft. head.

Surge Tanks. Surge Tanks, B F. Jakobsen. Am. Soc. Civil Engrs. Proc., vol. 48, no. 4, Apr. 1922, pp. 853-869, 15 figs. Distinction between surge tanks acceleration and deceleration and difference in requirements for medium-high head and high head plants.

HYDRO-ELECTRIC PLANTS

Auxiliaries, Selection of. Selection of Auxiliaries for Hydro-Electric Power Stations, F. H. Rogers. Power, vol. 55, no. 20, May 16, 1922, pp. 775-777, 4 figs. [illegible] Lubrication [illegible] for bearings. Small water wheels for auxiliary power.

Developments. Hydro-Electric Developments Involve an Expenditure of $150,000,000. Elec. World, vol. 79, no. 19, May 13, 1922, pp. 951-953, 2 figs. Construction in progress under licenses granted by Federal Power Commission involves almost 1,750,000 hp. Big Creek project largest for which license has been granted.

New Brunswick. New Hydro Plant in New Brunswick. Contract Rec., vol. 63, no. 20, May 17, 1922, pp. 474-477, 5 figs. Unique installation just completed at Musquash River near St. John. Actually 2 plants in one. Work of New Brunswick Power Commission.

Smoky Falls, Ont. Smoky Falls Development on the Sturgeon River, C. C Irvine. Can. Engr., vol. 42, no. 15, Apr. 11, 1922, pp. 377-379, 4 figs. Details of hydro-electric plant for Spanish River Pulp and Paper Mills at Smoky Falls, Ont. Present installation of 5200 hp. in two units with provision for two more units. Details of turbines and generators.

I

IMPACT TESTING

METHODS. A Discussion of Impact Testing Methods and the Results Obtained, John M. Lessells. Am. Soc. for Steel Treating Trans., vol. 2, no. 8, May 1922, pp. 659-672, 22 figs. Value of this method which shows up characteristics in heat-treated steel and not evident from conventional tests.

INDUSTRIAL MANAGEMENT

BOSSES. Management that Includes Bosses in the Office and in the Shop, Frank E. Gooding. Elec. Rev. & Indus. Engr., vol. 80, no. 5, May 1922, pp. 260-261. Influence of industrial engineering on earnings of Capital and Labor. Conservation of materials, plant and equipment, and labor. Discussion at meeting of Soc. Indus. Eng.

BRITISH FACTORY. Scientific Management in the British Factory, Wm. J. Hiscox. Am. Mach., vol. 56, no. 23, June 8, 1922, pp. 837-838. Considered by some a revolutionary movement; why it cannot be adopted as a whole; methods not popular with organized labor.

COST RECORDING AND PRODUCTION CONTROL. Cost Recording and Production Control in Drop-forging plants, H. F. Osler. Machy. (N. Y.), vol. 29, no. 10, June 1922, pp. 807-809, 3 figs. Description of system of management which has proven very successful in two drop-forging plants.

DIVERGENCE CHARTS. Divergence Charts and Their Uses, G. W. Greenwood. Management Eng., vol. 2, no. 6, June 1922, pp. 347-350, 4 figs. Means of presenting absolute differences between two magnitudes from month to month, and value of same.

INSPECTION METHODS. Inspection Methods, E. Fairbrother. Eng. Production, vol. 4, nos. 78, 79 and 80, Mar. 30, Apr. 6 and 13, 1922, pp. 303-306, 314-319 and 338-343, 35 figs. Development and practice. Notes on duties of an inspector; location of inspection department in factory. A system is described. Paper presented before Instn. Production Engrs.

MANAGER'S PROBLEMS. Solving the Manager's Present Day Problems, John H. Van Deventer. Indus. Management, vol. 63, no. 6, June 1922, pp. 321-324. Fixity and flexibility as factors in organization.

ORGANIZATION FOR SMALL PLANT. A Workable Organization Plan for the Small-Plant Manager, M. B. Bartlett. Factory, vol. 28, no. 6, June 1922, pp. 640-643, 662 and 664, 3 figs. Practical system covering cost and purchase records, routine adaptable to most small plants.

PERSONNEL DEPARTMENT, DUTIES OF. Duties of a Personnel Department in an Industrial Plant, Bruce F. Brown. Jl. Elec. & West. Industry, vol. 48, no. 11, June 1, 1922, pp. 443-444. How one successful western industry has solved industrial problems among its workers by developing scope of its personnel department.

PRODUCTION PLANNING. Planning with Equipment Standards, Chester D. Buoy. Indus. Management, vol. 63, no. 6, June 1922, pp. 363-365, 2 figs. Effective means of putting accurate and complete equipment standard data at service of planning department.

PRODUCTION REGULATION. Managing Production According to the Business Cycle, Ernest F. DuBrul. Management Eng., vol. 2, no. 6, June 1922, pp. 343-346, 1 fig. Fitting supply to demand in booms and depressions; analyzing business cycles.

RECORDS, EQUIPMENT AND INSPECTION. Equipment and Inspection Records. Elec. Rev. & Indus. Engr., vol. 80, no. 5, May 1922, pp. 211-213 and 216, 3 figs. Description of simple system which can be modified to suit large or small shop requirements.

WORKS ORGANIZATION. Works Organization, T. E. Pattinson. Eng. & Indus. Management, vol. 7, nos. 12, 13 and 14, Apr. 20, May 4 and 18, 1922, pp. 354-356, 388-391 and 430-431, 19 figs. Discusses ways of dealing with scrap and gives scrap charts. Machine-shop layout and operation. Paper read before Instn. Production Engrs.

INDUSTRIAL ORGANIZATION

MODERN. Modern Industrial Organization, Hugo Hirst. Electrician, vol. 88, no. 2297, May 26, 1922, pp. 625-626. Some views gathered from 35 years' experience along this line. Based on address before Assn. Civil Servants.

INSULATING MATERIALS

DIELECTRICS, HARD COMPOSITE. Insulating Materials. Beama, vol. 10, no. 5, May 1922, pp. 374-382, 19 figs. Test methods for use in investigation of mechanical and electrical properties. From publication issued by British Electrical and Allied Industries Research Assn.

INSULATION

REFRIGERATING FIELD. The Economic Thickness of Insulation in the Refrigerating Field, P. Nicholls. Am. Soc. Heating & Vent. Engrs. Jl., vol. 28, no. 3, Apr. 1922, pp. 343-358, 6 figs. Expense caused by leakage of heat, and formulas which include all definite expense factors. Consideration of case of walls of ice and cold storage houses.

INTERNAL-COMBUSTION ENGINES

HESSELMANS. A New Internal Combustion Engine (En ny forbränningsmotor), E. Hubendick. Teknisk Tidskrift, vol. 52, no. 16, Apr. 22, 1922, pp. 259-266, 15 figs. Describes in detail the Hesselmans engine, its construction, and results of tests made with it.

See also Aviation Engines, Diesel Engines, Oil Engines, semi-Diesel Engines.

IRON

SPONTANEOUS IGNITION OF ALUMINUM AND. Spontaneous Ignition of Iron and Aluminum Chips (Die Selbstentzündung von Eisen- und Aluminiumspänen). Warme- und Kälte-Technik, vol. 24, no. 8, Apr. 15, 1922, p. 97. Discusses the causes and recommends storage under water.

IRON ALLOYS

IRON-CARBON SYSTEM. On the Constitutional Diagram of Iron-Carbon System Based on Recent Investigations, K. Honda, Iron & Steel Institute, Advance paper no. 7, Meeting [illegible] May 1922, [illegible]. Brief summary of results [illegible] giving [illegible] diagram to meet new requirements.

IRON METALLURGY

OXIDIZING GASES, EFFECT OF. The Effect of Oxidizing Gases at Low Pressures on Heated Iron, H. C. H. Carpenter and [illegible]. Engineering, vol. 113, no. [illegible], May 12, 1922, pp. [illegible], 7 figs. [illegible] Paper read before Iron & Steel Inst.

L

LATHES

AUTOMATIC. Milling Eight Transmission Covers At One Time, J. H. Moore. Can. Machy., vol. 27, no. 18, May 4, 1922, pp. 33-35, 8 figs. Describes automatic lathe designed for rapid production of duplicate parts in large quantities.

TURRET. Saving Money by Means of the Turret Lathe, H. Alton. Can. Machy., vol. 27, no. 21, May 25, 1922, pp. 17-20, 10 figs. Production increased by efficient chucks and work-holding fixtures; indexing devices with ample wearing surface most suitable; machining hydraulic shock absorber; operations on bronze valve.

LIGHTING

BUILDINGS. The Lighting of Public Buildings, A. L. Powell and Edgar Parker. Illuminating Eng. Soc. Trans., vol. 16, no. 9, Dec. 30, 1921, pp. 533-550, 13 figs. Lighting of art galleries, statuary, museums, libraries, municipal, county and state buildings, and banks. Bibliography.

FACTORY. Lighting the Factory, S. G. Hibben. Factory, vol. 28, no. 5, May 1922, pp. 523-526, 6 figs. Discusses harnessing daylight with refracting prisms, curtains and ground glass; and substituting for artificial light in whole or in part.

INDUSTRIAL. Industrial Illumination. Eng. & Indus. Management, vol. 7, no. 14, May 18, 1922, pp. 450-451, 453, 455 and 460, 11 figs. Effect of good lighting on production; choice of lamps and fittings; correct light distribution; increasing workers' efficiency; economy in workshop.

STREET. Highway Lighting, H. H. Ashinger. Elec. Jl., vol. 19, no. 5, May 1922, pp. 194-195, 2 figs. Design features of lighting units.

Improved Lighting System to be Installed on Lincoln Highway, H. H. Bell. Elec. World, vol. 79, Apr. 15, 1922, pp. 731-732, 5 figs. Among features which it is intended shall mark completed work are concentration on light on roadway, flexibility of arrangement and reasonable cost of installation and maintenance.

The Value of Improved Street Lighting, C. H. Shepherd. Elec Jl., vol. 19, no. 5, May 1922, pp. 187-190, 4 figs. Bringing out importance of proper street illumination and value to community.

LIGHTNING ARRESTERS

COMPENSATED IMPULSE GAP. Same Wet and Dry Sparkover Obtained with Compensated Impulse Gap, C. E. Bennett, Elec. World, vol. 79, no. 21, May 27, 1922, pp. 1065-1067, 5 figs. Unaffected by weather conditions; most sensitive to impulse potentials; characteristics from test data; porous porcelain aids metal surfaces to relieve line disturbances.

LIGNITE

BURNING. Direct Drying of Brown Coal by Flue Gases and Firing the Dried Coal in Powder Form (Unmittelbare Trocknung der Rohbraunkohle mittels Feuergasen und Verheizung der getrockneten Kohle in Staubform), Max Weiss. Technische Blätter, vol. 12, No. 18, May 6, 1922, pp. 185-186, 3 figs. Describes installation of this kind in operation at Becker steel works at Willich.

CARBONIZATION. Lignite Carbonization: Carbonized Residue Briquettes, W. W. Odell, Gas Engr., vol. 38, no. 553, May 15, 1922, pp. 137-138. Results of experiments of Dr. E. J. Babcock, Univ. of N. Dakota which included briquetting and carbonizing in various combinations.

PULVERIZED, FIRING. Drying of Lignite and Firing Pulverized Lignite (Braunkohlen-Trocknung und Staubfeuerung) Weiss-Braunkohle, vol. 21, no. 5, May 6, 1922, pp. 79-85, 6 figs. Describes Brittner Lignite drying installation; pulverizing and storage of lignite; firing of pulverized lignite.

LOCOMOTIVES

CONSTRUCTION. Locomotive Construction. Eng. Production, vol. 4, nos. 79 and 80, Apr. 6 and 13, 1922, pp. 321-327 and 347-351, 28 figs. Methods in Great Western Works at Swindon, England.

POWER TRANSMISSION IN. Power Transmission in Locomotives From the Engine to the Wheels (Di alcuni dei principali biellismi per transmissione del movimento dai motori alle ruote nelle locomotive a motori rotanti), Andrea Caminati. Elettrotecnica, vol. 9, no. 10, Apr. 5, 1922, pp. 222-230, 19 figs. Principles of individual transmission, and for various combinations of wheels.

TURBINE TYPE. Turbine Locomotive Saves 52 Per Cent in Fuel. Ry. Age, vol. 72, no. 22, June 3, 1922, pp. 1295-1296, 1 fig. Describes many novel features of design brought out by Ljungstrom Turbine Co. of Sweden.

UNIFLOW, DEVELOPMENTS. Recent Developments in the Uniflow Locomotive. Ry. Mech. Engr., vol. 96, no. 5, May 1922, pp. 247-250, 7 figs. Exhasut ejector effect overcomes handicap of high compression and reduces size of cylinders.

LUBRICATING OILS

VISCOSITY. Influence of Viscosity on Operation of Oiling Systems, W. F. Osborne. Power, vol. 55, no. 21, May 23, 1922, pp. 820-821. Mechanical considerations where oil is to be used; effect of viscosity.

LUBRICATION

FILTERING METHODS. Modern Filtering Methods for Lubricating Systems, W. F. Osborne. Power, vol. 55, no. 24, June 13, 1922, pp. 930-931, 3 figs. Advantages and disadvantages of five general methods.

LUMINESCENCE

RADIO. Radioluminescence and Its Technical Application, Victor F. Hess, Illuminating Eng. Soc. Trans., vol. 17, no. 3, Mar. 1922, pp. 127-134 and (discussion) 144-146. Describes processes of production of "radium luminous material" and demonstrates its technical application. Computation of economy of luminous material.

M

MACHINE TOOLS

DESIGN. Tool Engineering, Albert A. Dowd and Frank W. Curtis. Am. Mach., vol. 56, no. 19, May 11, 1922, pp. 702-705, 6 figs. Methods employed in designing tools for turret lathes. Use of layouts and sketches, familiarity with machines necessary for designer.

DESIGN STANDARDS. Tool Design Standards, H. P. Losely. Machy. (N.Y.), vol. 28, no. 9, May 1922, pp. 713-715, 2 figs. Development of standard instruction sheets for use of tool designers.

Railway Shops. Machine Tools in the Railway Shop. [illegible] Production, vol. 4, nos. 76-77-78, 79, 80, 81, 82 and 83, Mar. 16, 23, 30, Apr. 6, 13, 20, 27 and May 4, 1922, pp. 244-248, 279-283, 293-297, 32[illegible], [illegible], 366-370, 398-403 and 427-432, 106 figs. Review of latest practice in [illegible] tool and other equipment designed for use in railway shops. Describes representative types of modern equipment.

MACHINE WORK

Optical Instruments, Use in. Use of Optical Instruments in Machine Work. Am. Mach., vol. 56, no. 19, May 11, 1922, pp. 697-701, 19 figs. Microscope and projector used to check location and contour of work. Accurate gear and rack cutting; an eyepiece with radial lines.

MAGNESIUM

Use in Foundry. Magnesium and Its Use in the Foundry (Le Magnésium et son utilisation en Fonderie), J. Gaillard. Fonderie Moderne, no. 1, Jan. 1922, pp. 17-21. Substitution of aluminum by magnesium, and chemical properties of latter; magnesium alloys; etc.

MAGNESIUM ALLOYS

Dowmetal. Dowmetal and Its Application, J. A. Gann. Am. Soc. for Steel Treating Trans., vol. 2, no. 7, Apr. 1922, pp. 607-615 and (discussion) 615-619, 14 figs. Describes series of magnesium alloys produced by the Dow Chemical Co., commercially known as dowmetal. Characteristics and uses.

MATERIALS

Pressure Effect on Physical Properties. Change of the Physical Properties of Materials with Pressure, Erskine D. Williamson. Franklin Inst. Jl., vol. 193, no. 4, Apr. 1922, pp. 491-513, 8 figs. Tools employed in experiments. Change of electrical resistance with pressure; effect of pressure on thermo-electromotive force at junction of two metals; conductivity of solutions; effect of pressure on compressibility; and on viscosity of liquids.

MEASURING INSTRUMENTS

Selection and Use. The Selection and Use of Instruments in Industrial Plants, Frederick J. Schlink. Management Eng., vol. 2, no. 6, June 1922, pp. 337-342, 6 figs. Importance of care in selection and use, and suggestions.

METALS

Electrodeposited. Idiomorphic and Hyp-Idiomorphic Structures in Electro-Deposited Metals, W. E. Hughes. Am. Electrochem. Soc. advance paper, no. 5, meeting, Apr. 27-29, 1922, pp. 35-48, 6 figs. Author seeks to show that idiomorphic structure occurs in deposits of copper, zinc and iron, when they are formed during prevalence of certain conditions of deposition common to the three cases.

Kinetic Theory and Thermal Energy. On the Kinetic Theory of Solids (Metals) and the Partition of Thermal Energy, B. M. Sen. Lond., Edinburgh, & Dublin Philosophical Mag., vol. 43, no. 256, Apr. 1922, pp. 672-687, 1 fig. Part. 1: Investigation of theory of solid state with rough working model of 14 molecules placed on sphere about each individual molecule at center. Part II: Restatement of theory for cubic and face-centered cubic crystals.

Mechanical Properties. On the Variation of Mechanical Properties of Some Metals and Alloys at Low Temperatures (Sur la variation des propriétés mécaniques de quelques métaux et alliages aux bases températures), Léon Guillet and Jean Cournot. Revue de Métallurgie, vol. 19, no. 4, Apr. 1922, pp. 215-221, 9 figs. Describes experiments with special steels, ferronickel, cobalt, copper alloys, and aluminum alloys, and gives results in tabular form.

MICA

Geology and Mining. Geology and Mining of Mica, J. Volney Lewis. Eng. & Min. Jl-Press., vol. 113, no. 20, May 20, 1922, pp. 856-864, 4 fig. Deposits mainly associated with pegmatites. Valuable by products may be recovered. Mining generally shallow and of small magnitude. Modern methods being introduced.

Properties and Uses. Properties and Uses of Micas. Instn. Elec. Engrs. Jl., vol. 60, no. 307, Mar. 1922, pp. 339-342 and (discussion) 342-346. Notes on specifications, identification tests; selection; mica and micanite for commutators; commutator segment separators; rings and cones. Report from British Elec. & Allied Industries Research Assn. See also India-Rubber Jl., vol. 63, no. 19, May 13, 1922, p. 168.

MINERAL RESOURCES

Australia. Geology and Mineral Resources of the North-West, Central, and Eastern Divisions, H. W. B. Talbot. Geol. Survey (West. Australia) Bul., no. 83, 1920, 226 pp. 70 figs. partly on supp. plates. Results of reconnaissance surveys and explorations covering in general way large tracts of country, describing physical features of structural geology, and giving complete account of its mineral and pastoral resources.

MINES

Surveying. Methods of Measuring Horizontal Angles Involving Steep or Precipitous Sighting, L. H. Cooke. So. African Eng., vol. 33, nos. 3 and 4, Mar. 31 and Apr. 29, 1922, pp. 50-54 and 69-70. Mar. 31: Efficiency in mine surveying; testing theodolites for obliquity of plate and limb-axes; methods in which striding bubble is used; etc. Apr. 29: Methods with theodolites having supersensitive plate bubbles.

MONEL METAL

Electrical Properties. Some Electrical Properties of Nickel and Monel Wires, M. A. Hunter, F. M. Sebast and A. Jones, Trans. Amer. Inst. Min. & Met. Engrs. issued with Min. & Metallurgy, May 1922, No. 1159-N, 6 pp. 2 figs. Investigation of specific resistance and temperature coefficient of electrical resistance of nickel and monel metal.

MOTORS

Conductor Sizes for Peak-Load. Determining Sizes of Motor Circuits for Peak-Load Duty, Edgar P. Slack. Power, vol. 55, no. 22, May 30, 1922, pp. 853-854, 2 figs. Examples of motors operating under severe conditions and computations for conductor sizes.

MOTOR TRUCKS

Design. Motor Truck Design from the Truck Buyer's Viewpoint, Cornelius R. Myers. Indus. Management, vol. 63, no. 5, May 1922, pp. 273-281, 11 figs. Important features in buying transportation which might be overlooked in salesman's emphasis on detail.

Logging Methods. Motor Truck Logging Methods, Frederick Malcolm Knapp. Univ. of Wash. Eng. Exper. Station Bul., no. 12, Apr. 1921, pp. 3-29, 13 figs. Useful facts for ordinary truck type not including tractor and caterpillar.

Producer Gas Fueled. Land Transport and the Gas Producer, R. J. Mitchell. Eng. Rev., vol. 35, no. 10, Apr. 1922, pp. 335-337, 1 fig. Description of gas producer developed by D. J. Smith applied to motor truck which shows marked economy over liquid-fueled type.

N

NON-FERROUS METALS

Gas Absorption and Oxidation. Gas Absorption and Oxidation of Non-Ferrous Metals, B. Wyoski and J. W. Beeck. Trans. Amer. Inst. Min. & Met. Engrs. issued with Min. & Metallurgy, May 1922, no. 1160-N, 8 pp., 2 figs. Argument that oxidation and gasings of bronzes and red brasses cannot take place simultaneously, and conditions effecting each.

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OIL

Crude. Properties of Some Typical American Crude Oils. Oil Eng. & Finance, vol. 1, no. 19, May 29, 1922, pp. 613-616. Selected analyses from Western oils and 39 from Eastern fields, carried out under auspices of U. S. Bur. Mines.

OIL ENGINES

Airless-Injection. New Airless-Injection System for Oil Engines, E. Lundgren. Motorship, vol. 7, no. 6, June 1922, pp. 444-445, 4 figs. Remarkable results obtained from highly scientific experiments made by Hesselman in Sweden.

Design and Operation. Oil Engine Hints. Power Plant Eng., vol. 26, no. 11, June 1, 1922, pp. 565-569, 5 figs. Proportions, installation of engine, operating suggestions for modern installations.

Foundations. An Erector's Experiences in Building Oil-Engine Foundations, L. H. Morrison. Power, vol. 55, no. 17, Apr. 25, 1922, pp. 651-654, 8 figs. Increasing use of this type of engine makes consideration of details of foundation design important.

OIL SHALES

Distillation, Analytical. Analytical Distillations of Typical Shale Oils, Martin J. Gavin. U. S. Bur. of Mines Reports on Investigations, serial no. 2332, Mar. 1922, 12 pp. Important characteristics of oils discussed are summarized. Results of re-distillations of oils from Utah shales, are tabulated, showing change in quality caused by repeated re-distillations.

OPEN-HEARTH FURNACES

Design. Design of Open-Hearth Furnaces, A. D. Williams. Iron Age, vol. 109, no. 16, Apr. 20, 1922, pp. 1075-1076. Consideration of port areas and velocities as affected by pressures; chimney height determined.

Fuel Utilization. Utilizing Fuels in Open Hearths, Herbert F. Miller, Jr. Iron Trade Rev., vol. 70, no. 23, June 8, 1922, pp. 1646-1647 and 1650, 6 figs. Present pressures of both air and gas in gas-fired furnaces are too low and should be increased from ounces to pounds; experiments show that time of heating may be reduced. From paper read before Am. Iron & Steel Inst.

Valve Design. Improving Reversing Valve Design, Wm. C. Bulmer. Iron Trade Rev., vol. 70, no. 22, June 1, 1922, pp. 1560-1561. Types of air or gas valve providing most effective seal and affording unrestricted passage is considered best for open hearths; water-cooled slide with inclined seat is favoured.

ORE TREATMENT

Chloridizing Volatilization. Heat Requirements in Chloridizing Volatilization, Rudolf Gahl, Eng. & Min. Jl. Press, vol. 113, no. 22, June 3, 1922, pp. 957-958, 1 fig. Fuel consumption appears crucial point in commercial application of process; depends chiefly on tonnage, draft, and radiation.

OSCILLOGRAPHS

Turbo-Generator Investigation. Investigation of Oscillation Phenomena in Turbo-Generators (Untersuchung von Schwingungserscheinungen an Turbo dynamos mit Hilfe des Vibrographen), Jos. Geiger. Zeit. des Vereines deutscher Ingenieure, vol. 66, no. 18, May 6, 1922, pp. 437-440, 39 figs. Explains investigation by means of vibrograph; methods of measuring used; successful methods adopted to eliminate vibration.

OSMOSIS

Electro, Application of. Electro-Osmosis and Its Applications, Paul Bary, Chem. Trade Jl. & Chem. Engr., vol. 60, no. 1827, May 26, 1922, pp. 625-627. Commercial applications of this phenomenon becoming daily more important. Translated from Chimie et Industrie, Apr. 1922.

OXY-ACETYLENE CUTTING

Cutting Machines. Efficiency of Machine Cutting, F. J. Maeurer. Welding Engr., vol. 7, no. 5, May 1922, pp. 17-23, 25 figs. Cutting with oxy-acetylene torch can be made to approach very closely maximum theoretical efficiency. Paper read before Am. Welding Soc.

Underwater. Cutting Metals Under Water. Robert G. Skerrett. Compressed Air. Mag., vol. 27, no. 5, May 1922, pp. 129-133, 14 figs. Repairing broken 36-in. diam. water main under New York Harbor by means of submarine torch and compressed air.

OXY-ACETYLENE WELDING

Water Main, Submarine. The Repair of The New York-Brooklyn Submarine Water Main. Engineering, vol. 113, no. 2939, April 28, 1922, pp. 509-511, 8 figs. Account of procedure and discussion of apparatus used.

P

PAINTS

[illegible] INTEGRATING SPHERES, FOR. Paints for Integrating Spheres, A. H. Taylor. Illuminating Eng. Soc. Trans., vol. 16, no. 9, Dec. 30, 1921, pp. [illegible] and [illegible] pp. [illegible]. Requirements of satisfactory paint. Preparation of zinc oxide paint [illegible] being used at Bur. of Standards.

PAPER MANUFACTURE

POWER. Power Used in Papermaking, A. G. Darling and H. W. Rogers. Paper, vol. 30, no. 7, Apr. 19, 1922, pp. 20-24. Heat and mechanical energy must be balanced. Demands for steam in processes.

WATERWHEELS. Waterwheels in Making Groundwood, Adolph F. Meyer. Paper vol. 30, no. 7, Apr. 19. 1922, pp. 58-66. Suggestions as to selection and regulation of speed of waterwheels for grinding machinery. Paper read before Tech. Assn. of Pulp & Paper Industry.

PAPER MILLS

ELECTRIC GENERATION OF STEAM. Electric Generation of Steam, Horace Drever and Frank Hodson. Paper, vol. 30, no. 7, Apr. 19, 1922, pp. 73-75 and 78-81, 3 figs. Recent development in conversion of electric energy into steam by means of electric steam generator; underlying theories and practical application. Paper read before Technical Assn. of Pulp and Paper Industry.

ELECTRICITY IN, USE OF. Electricity in the Paper Mill, R. W. Leeper. Paper, vol. 30, no. 7, Apr. 19, 1922, pp. 24-28. Uses of the force from power plant to finished product.

WATERPOWER SOURCES, CANADA. Mill Waterpower Sources in Canada. Paper, vol. 30, no. 7, Apr. 19, 1922, pp. 11-18, 8 figs. Paper prepared by Dominion Water Power Branch of Dept. of Interior, Ottawa, Ont., giving power supply of various mills in Canada.

PAVEMENTS

DESIGN. Recent Changes in Pavement Design. Pub. Works, vol. 52, no. 15, Apr. 15, 1922, pp. 262-264. 150 cities report changes made last year in base, binder, cushion, joint filler, kind or proportion of aggregate, use of reinforcement, and other details.

WHEEL LOADS, DISTRIBUTION OF. Distribution of Wheel Loads on Pavement Sections H. F. Clemmer and C. A. Hogentogler. Good Roads, vol. 62, no. 20, May 17, 1922, pp. 273-278, 4 fig. Part of investigational work at Bates Experimental Road, Ill. Div. of Highways. Observation of deflections of various surfaces and pressures delivered to subgrade during passage of heavy motor truck wheels.

PAVEMENTS, ASPHALT

SPECIFICATIONS, STANDARDIZED. Standardized Specifications for Mineral Aggregates for Asphalt Pavements, Roy M. Green. Can. Engr., vol. 42, no. 20, May 16, 1922, pp. 496-498. Not desirable to have too rigid specifications for agregates; sheet asphalt paving mixtures; proposed asphalt concrete specifications. Paper read at Am. Road Bldrs. Assn. convention.

PAVEMENTS, CONCRETE

DAY'S WORK. What is a Day's Work Laying Concrete Pavement? H. K. Davis. Eng. News-Rec., vol. 88, no. 18, May 4, 1922, pp. 720-723. Construction progress on 31 contracts by 19 contractors using 29 outfits in 17 counties in Iowa in 1921 gives answer. Shows how small a part of year actual work is done.

PETROLEUM

BIBLIOGRAPHY. Recent Articles on Petroleum and Allied Substances. U. S. Bur. of Mines Reports on Investigations, serial no. 2340, Mar. 1922, 29 pp. Bibliography compiled by E. H. Burroughs.

FEDERAL SPECIFICATION REVISION. Federal Government Revises Petroleum Specifications. Automotive Industries, vol. 46, no. 19, May 11, 1922, pp. 1012-1013, 1 fig. Color test only change of importance in respect to motor gasoline. Points on distillation curve unchanged. Viscosity limits on lubricating oils are altered and some minor changes are made in other items.

PHOSPHOR-BRONZE

PROPERTIES AND MANUFACTURE. Phosphor Bronze from the Engineering Standpoint R. T. Rolfe. Metal Industry, vol. 20, nos. 18 and 19, May 5 and 12, 1922, pp. 413-416 and 437-438, 3 figs. May 15: Classification, composition and tests. Manufacture, microstructure and bearing properties of 85:15. May 12: Alloys for [illegible] wheels and characteristics. Manufacture and uses of malleable.

PHOTOELASTICITY

APPLICATION TO ENGINEERING PROBLEMS. Photo-Elasticity and Its Application to Engineering Problems, P. Heymans. Tech. Eng. News, vol. 3, no. 3, June 1922, pp. [illegible] and 108, 27 figs. Application of temporary birefraction properties shown by transparent bodies when stressed, on general stress determinations.

PIGMENTS

[illegible] Manufacture and Properties of [illegible] White. Fabrication et propriétés [illegible] C. Coffignier. Chimie & Industrie, vol. 7, no. 4, Apr. 1922, pp. 651-661, 11 figs. Manufacture and properties of white pigments in Norway, America and France; describes Devaux, Paquet and Andreu processes.

PIPE LINES

CAPACITY [illegible] CHART. A [illegible] Chart for Calculating Pipe Line Capacities, C. H. M. Burnham. Natural Gas Industry, vol. 16, no. 5, May 1922, p. 165. Graphic method of solving usual pipe lines capacity equation.

SUBMERGED INTAKE. Submerged Intake for 24-in. Pipe Placed without Diver, George W. Pracy. Eng. News Rec. vol. 88, no. 19, May 11, 1922, pp. 786-788, 5 figs. Concrete anchor block cast on shore, floated to place and sunk simul[illegible]

[illegible] Steam, [illegible] ing pipe diameter for least steam loss on saturated steam lines; most economic [illegible]

PIPES

ECONOMIC SIZE. Economic Size of Pipe for Power Purposes, George E. Lyon. Eng & Contracting. vol. 57, no. 19, May 10, 1922, pp. 436-437, 1 fig. Formulas and curves from which proper diameters can be found.

PIPES, CAST-IRON

FLEXIBLE JOINT. Making 30-Inch Flexible Joint Cast-Iron, William G. Hammerstrom. Eng. News-Rec, vol. 88, no. 19, May 11, 1922, pp. 780-782, 5 figs. Spherical-shaped bell and spigot on each length machined to give flexibility at every joint; foundry practice.

PISTONS

DOWMETAL. A Superior Piston Material. Motor Boating, vol. 29, no. 6, June 1922, pp. 39 and 100, 2 figs. Dowmetal an alloy composed of high percentage of magnesium and small accounts of other metals, manufactured by Dow Chem. Co., Midland, Mich., for pistons of internal-combustion engines, equal, if not superior, to cast iron or aluminum.

MACHINING. Tooling Equipments for Pistons. Machy. (Lond.), vol. 20, no. 504, May 25, 1922, pp. 220-224, 13 figs. Use of automatic machines and special equipment for machining pistons at high rate of production.

POLES, WOODEN

PRESERVATION. On the Preservation of Wooden Transmission Poles (Erhönte Bedeutung der Mittel zur Verlängerung der Lebensdauer von hölzernen Leitungsmasten), Wintermeyer. Elektrotechnischer Anzeiger, vol. 39, no. 61-62, Apr. 19, 1922, pp. 521-522. Use of bichloride of mercury, zinc chloride and other baths for impregnating wooden poles.

POWER FACTOR

CORRECTION. Power-Factor Correction by Rearrangement of Motor Drives, T. H. Arnold. Power, vol. 55, no. 23, June 6, 1922, pp. 886-889, 3 figs. Four methods of power factor correction.

POWER GENERATION

RATING OF SUPPLY UNDERTAKINGS. The Rating of Electric Power Supply Undertakings, L. Andrews. Elec. Times, vol. 61, no. 1596, May 18, 1922, pp. 477-478, 1 fig. Economic consideration of various factors and necessity of analyzing same.

POWER PLANTS

AUXILIARIES. Power Plant Auxiliaries, L. R. Lee. Power Plant Eng., vol. 26, no. 11, June 1, 1922, pp. 553-557, 4 figs. Requirements and types used in modern plants.

AUXILIARIES DRIVE. Under What Conditions are Steam Turbines Preferable to Electrical Units for Driving Auxiliaries? Coal Age, vol. 21, no. 21, May 25, 1922, pp. 875-876, 1 fig. Turbines save conversion costs; independent steam units may release large generator at times of idleness; cheap fuel makes heat balance less imperative.

CALUMET STATION, CHICAGO. Calumet Station. Power Plant Eng., vol. 26, no. 10, May 15, 1922, pp. 497-508, 17 figs. Description of Commonwealth Edison Company's new plant which will ultimately produce 180,000-kw.

HELL GATE. New Hell Gate Power Station. Power, vol. 55, no. 18, May 2, 1922, pp. 678-686, 12 figs. Description and table of principal equipment of this plant of United Elec. Light & Power Co.

The Hell Gate Station, Howard W. Leitch. Elec. Jl., vol. 19, no. 5, May 1922, pp. 214-220, 14 figs. Layouts, curves, illustrations and general description.

Maintaining Heat Balance at Hell Gate. Power, vol. 55, no. 20, May 16, 1922, pp. 760-763, 4 figs. Features of units and control.

Switching Equipment for the Hell Gate Station, C. M. Moss and J. B. Macneill. Elec. Jl., vol. 19, no. 5, May 1922, pp. 221-226, 10 figs. Description of unusually good installation at this plant.

LOTS ROAD STATION, LONDON. Lots Road Power Station, London "Underground" Railways. Ry. Gaz., vol. 36, no. 19, May 12, 1922, pp. 777-780, 3 figs. This station, opened in Feb. 1905, is largest in British Isles erected for supplying current for railway traction and associated purposes. New plant recently added is described, and main features of original equipment, in so far as it still applies, are set forth.

POWER TRANSMISSION

DRIVE, UNIT AND LINE. Comparative Advantages of Unit and Line Drive in Industry, H. P. Phillips. Jl. Elec. & West. Industry, vol. 48, no. 11, June 1, 1922 pp. 445-447, 6 figs. Discussion of mechanical installations in some important western industrial plants tending to show that adoption of unit or line drive depends upon type of work to be done.

EFFICIENCY IN. Power Transmission and Production, M. A. Nicholls. Eng. & Indus. Management, vol, 7, no. 11, Apr. 6, 1922, pp. 316-318. Deals with motor overload, question of overtime, ascertaining horsepower and belt stretch. Points out economical utilization of power depends largely upon efficiency of facilities provided for transmission.

ELECTRIC VS. MECHANICAL. The Merits of Electrical vs. Mechanical Power Transmission, R. Gillespie Williams. Eng. & Indus. Management, vol. 7, no. 11, Apr. 6, 1922, pp. 319-322, 3 figs. Deals with questions relating to running costs and maintenance, and economical arrangement of electric generator plant.

FLUID WAVES. Transmitting Power in Fluid Waves. Sci. Am., vol. 126, no. 5, May 1922, pp. 320 and 362. Setting up wave motions or pulsations in enclosed column of liquid, usually water, which is contained in pipe connecting wave-generating apparatus with point of power, application. Discusses generator now on market and applications.

MACHINERY. A Review of Power-Transmission Machinery. Belting, vol. 20, nos. 4 and 5, Apr. and May 1922, pp. 29-30 and pp. 36 and 38, 10 figs. Apr.: Deals with steel hangers. May: Steel pulleys and one type of steel hanger.

PRECIPITATION

ELECTRICAL. Application of Electrical Precipitation to the Wood-Distillation Process, L. F. Hawley and H. M. Pier, Chem. & Met. Eng., vol. 26, no. 22, May 31, 1922, pp. 1031-1033, 3 figs. Tests on experimental wood-distillation retort indicate possibility of precipitating tar from hot vapors by means of cottrell precipitator, thus reducing amount of soluble tar in pyroligneous acid to a point where direct neutralization is feasible. Paper read before Am. Chem. Soc.

PRESSES

ACCIDENT ELIMINATION. Eliminating Cold Trim Press Accidents, G. A. Kuechenmeister, Can. Machy., vol 27, no. 21, May 25, 1922, pp. 21-29, 2 figs. Danger of working on unguarded presses; repeating of press ram not always cause of trouble; unsatisfactory experiments with mechanical tripping devices; electrical guard which has solved problem

PULVERIZED COAL

Boiler Firing. Commission of Fuel [illegible] Commission d'Utilisation du Combustible. Annales des Mines, [illegible] 2 Feb. 1922, pp. 90-152. Firing with pulverized coal. [illegible] pulverized coal; description of installation using it; detailed description of advantages and drawbacks.

Boiler Firing, American Practice. Powdered Coal, John Blizard. Colliery Guardian, vol. 123, nos. 3198, 3199 and 3201, Apr. 13, 21 and May 5, 1922, pp. 918-919, 990-991 and 1119-1120, 10 figs. Apr. 13: Functions of powdered fuel plant, preparation and distribution of fuel. Apr. [illegible]: Various appliances employed in use of pulverized fuel; applications of powdered fuel. May 5: Use of powdered fuel in raising of steam; cost and inherent dangers involved. From Bul. Can. Dept. Mines.

Power Plants. First Large Plant Using Pulverized Coal Exclusively. Elec. World, vol. 79, no. 15, Apr. 15, 1922, pp. 720-724, 13 figs. partly on supp. plate. Lakeside generating station of Milwaukee Elec. Ry. & Light Co. designed for initial capacity of 40,000 kva., with ultimate rating of 200,000 kva. Central control and minimum of attendance. See also Power, vol. 55, no. 16, Apr 18, 1922, pp. 604-610, 16 figs. partly on supp. plate, and Elec. Ry. Jl., vol. 59, no. 15, Apr. 15, 1922, pp. 633-640, 15 figs. partly on supp. plate.

PUMPING PLANTS

Coal Mines, Efficiency in. Pipe Friction and Pump Efficiency, William Brazenall. Instn. Min. Engrs. Trans., vol. 63, part 1, Mar. 1922, pp. 59-69, 1 fig. Account of experiments carried out with original intention to find cost of pumping worked out in terms of actual horsepower for three types of pumps, namely, turbine, three-throw ram, and differential ram. Shows results obtained from pumping plant at modern coal mine.

Hamilton, Ont. Beach Water Works Pumping Plant at Hamilton, R. De Bruno-Austin. Can. Engr., vol. 42, no. 19, May 9, 1922, pp. 462-468, 8 figs. General description of machinery, with special reference to recent installations of 2 ten-million-gallon pumping units; tests show efficiencies as high as 80 per cent; historical review of earlier equipment.

Maple Ridge, B. C. New Pumping Plant for the Maple Ridge Dyking in B. C., H. M. Burwell. Contract Rec., vol. 63, no. 20, May 17, 1922, pp. 465-467, 4 figs. Old pumps in service for 27 years for reclaiming 9,000 acres of rich land replaced by two 20,000 g.p.m. electrically-driven centrifugal pumps. Unusual type of valves.

PUMPING STATIONS

Stand-By Service. A 2,500-Kva. Diesel-Engine Plant for Stand-by Service, Homer [illegible]. Power, vol. 55, no. 21, May 23, 1922, pp. [illegible], 8 figs. Calumet station equipped with four 750-b.hp. two-stroke cycle Diesel-engine generator units, insuring breakdown service for sewage-pumping stations.

Q

QUARRYING

Explosives, Use of. Use of Explosives in Production of Crushed Stone, S. R. Russel. Eng. & Contracting, vol. 57, no. 16, Apr. 19, 1922, pp. 371-374. Selection and methods of using explosives in quarrying. Paper delivered before Nat. Crushed Stone Assn.

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RADIO COMMUNICATION

Amplifiers. Potentiometer Control of H. F. Amplifiers, S. O. Pearson. Wireless World, vol. 110, no. 8, May 20, 1922, pp. 235-237, 5 figs. Potentiometer method of controlling tendency for continuous oscillations in high-frequency amplifying circuits.

Four-Electrode Valves. Four-Electrode Valves and Their Circuits, H. de A. Donisthorpe. Wireless World, vol. 10, nos. 7, 8 and 9, May 13, 20 and 27, 1922, pp. 198-201, 230-235, and 265, 8 figs. Discussion. Description of the various forms of quadrodes and their corresponding circuits.

Long-Distance. Long Distance Radio Communication, L. W. Austin. Franklin Inst. Jl., vol. 193, no. 4, Apr. 1922, pp. 437-459, 9 figs. Development of the electron tube; comparison of three methods of generating continuous waves, namely, arc, high-frequency alternator, and electron-tube generator; antennae used in high power [illegible] elimination of atmospheric disturbances. Projects for extremely long-distance radio communications.

Modulation, Theory of. Notes of the Theory of Modulation, John R. Carson. Inst. of Radio Engrs., Proc. vol. 10, no. 1, Feb. 1922, pp. 57-64. Transmission system of frequency modulation mathematically analyzed. That it is inferior to amplitude variation system is proved.

RADIOTELEGRAPHY

Decrement of Distant Station. The Determination of the Decrement of a Distant Station by Means of a Coil Aerial, J. Erskine-Murray and B. Williams. Instn. Elec. Engrs. Jl., vol. 60, no. 307, Mar. 1922, pp. 347-351 and (discussion) pp. 356-362, 6 figs. Method of measuring decrement of distant transmitting station, based on fact that if coil aerial be in a plane 45 deg. of the bearing of station, current induced in it, is $1/\sqrt{2}$ of that when on bearing.

Power for. The Provision of Power for Wireless Telegraphy, J. H. Wittaker-Swinton. Beama, vol. 10, no. 5, May 1922, pp. 383-391, 6 figs. Survey of forms of high-tension power; present practice and statement of probabilities regarding future. Extract of paper read before I.E.E.

RAILWAY ELECTRIFICATION

Chile. Electrification on the Chilean Railway. Ry. & Locomotive Eng., vol. 35, no. 5, May 1922, pp. 111-115, 6 figs. Solution of high cost of fuel, and congested traffic. Descriptions of locomotive equipment.

Industrial Plants. Yard Electrification of Industrial Plant Railways, D. M. Petty. Engrs. & Eng., vol. 1, no. 3, Mar. 1922, pp. 79-84 and 96-97. Underrunning third-rail scheme is best suited for heavy work and low voltages; existing substations used to supply d.c. power; etc.

Mountain Districts. Advantages of Electrical Operation in Mountain Districts, Frank Rusch. Gen. Elec. Rev., vol. 25, no. 6, June 1922, pp. 362-364. Some features of 660 route miles operation of C., M., & St. Paul Ry. Co., on five mountain ranges. (Reprinted from Milwaukee Employees Mag., Mar. 1922).

RAILWAY MANAGEMENT

Chinese Government. The Administration of Chinese Government Railways, Ching-Chun Wang. Assn. Chinese & Am. Engrs. Jl., vol. 3, no. 1, Jan. 1922, pp. 3-16, 2 figs. Development; statistical features; central administration; improvements.

RAILWAY MOTOR CARS

Diesel-Electric. Diesel-Electric Motor Cars for Railway Service. Ry. Age, vol. 72, no. 20, May 20, 1922, pp. 1183-1184, 2 figs. Successful operation in Sweden has led to introduction of 250-hp. cars.

Gasoline. Some Recent Developments in Gasoline Motor Rail Cars, W. L. Bean. Ry. Rev., vol. 70, no. 21, May 27, 1922, pp. 741-747, 8 figs. Present equipment admirable in design but limited in capacity; railways need larger cars built on same principle.

Gazoline Engine. The Power Behind the Modern Gasoline Motor Rail Car. Ry. Rev., vol. 50, no. 19, May 13, 1922, pp. 669-673, 6 figs. Features to which consideration must be given in selection of power unit for gasoline rail car operation. Describes Midwest heavy-duty high-speed engine.

RAILWAY OPERATION

Amphibious. By Rail and By Water. Sci. Am. vol. 126, no. 6, June 1922, p. 374, 5 figs. Combination train and two barges invented by Belgian engineer for use in Congo.

Parallel Traffic Working. "Parallel" Traffic Working on South Eastern & Chatham Railway. Ry. Gaz., vol. 36, no. 20, May 19, 1922, pp. 805-814, 7 figs. By systematic scheduling of trains on "Parallel" basis in both directions, time-keeping is improved, facilities increased, signalling movements reduced, and engines and rolling-stock utilized to better advantage.

Suburban Passenger Service. The Operation of Heavy Suburban Passenger Services on A Steam Railway, F. V. Russell. Ry. Gaz., vol. 36, no. 21, May 26, 1922, pp. 841-842. Steam and electric traction compared. Suggestions for adoption by steam railways of features in use in electrically-operated ones. From Lecture before Roy. Soc. Arts.

RAILWAY SHOPS

Tools and Fixtures. Special Tools and Fixtures in a Southern Railroad Shop, S. Ashton Hand. Am. Mach., vol. 56, no. 17, Apr 27, 1922, pp. 613-616, 15 figs. Describes equipment of shops of Chesapeake & Ohio Ry., Richmond, Va.

RAILWAY SIGNALING

Interlocking. New Interlocking on the C.R.R. of N.J., Fred W. Bender. Ry. Signal Engr., vol. 15, no. 5, May 1922, pp. 184-189, 14 figs. Large Electro-pneumatic plant at Phillipsburg, N.J. uses new operating mechanisms and lead-covered cables.

Location of Signals. Location of Signals as an Aid to Traffic Working, R. S. Proud. Engineering, vol. 113, no. 2939, April 28, 1922, pp. 533-535, 3 figs. Signals from standpoint of traffic handling rather than safety. Paper read before Instn. Ry. Signal Engrs.

RAILWAY TERMINALS

Electrification. Operation of an Electrified Terminal, L. E. Lynde. Elec. Traction, vol. 28, no. 5, May 1922, pp. 403-404, 2 figs. Conditions at Broad Street Station, Philadelphia, as compared with steam operation on this portion of Penna. system.

RAILWAY TIES

Electric Resistance. Electrical Resistance of Treated and Untreated Crossties, P. R. Hicks. Ry. Signal Engr., vol. 15, no. 5, May 1922, pp. 190-192, 2 figs. Results of measurements made by Forest Prod. Laboratory in co-operation with Chicago, Milwaukee, & St. Paul.

RAILWAY TRACK

Crossings. 11 Types of Railroad Crossings. Eng. & Contracting, vol. 57, no. 16, Apr. 19, 1922, pp. 375-377, 11 figs. Information regarding different types of crossings given in preliminary report presented before Am. Ry. Eng. Assn. (Abstract.)

Machines for Track Work. Special Machines and Combinations for Track Work. Eng. & Contracting, vol. 57, no. 16, Apr. 19, 1922, pp. 368-370, 3 figs. Information on use of mechanical appliances and tools in track work and organization of labor involved, given in appendix to report presented before Am. Ry. Eng. Assn. by Committee on Rules and Organization. (Abstract.)

Maintenance. Applying Machinery to Railway Maintenance of Way, Robert H. Ford, Eng. News-Rec., vol. 88, no. 20, May 18, 1922, pp. 821-825. Enormous aggregate economy seen in use of labor-saving and material handling devices for track work. (Abstract.) Paper read before West. Soc. of Engrs.

REDUCTION GEARS

Double. Double Reduction Gears in the SS. "Melmore Head," J. W. Wilkie. Engineering, vol. 113, no. 2837, Apr. 14, 1922, pp. 469-471, 6 figs. Detailed account of troubles experienced with double-reduction gearing, together with description of methods recently adopted to overcome them. [Paper read at Spring Mtg. of I. N. A.] See also Mar. Engr. & Naval Archt., vol. 45, no. 536, May 1922, p. 190 and Shipbldg & Shipg. Rec., vol. 19, no. 15, Apr. 13, 1922, pp. 457-460.

Turbine. Turbine Reduction Gearing and Its Production, J. H. Melloy. Mar. Engr. & Naval Architect, vol. 45, no. 536, May 1922, pp. 184-187, 3 figs. Hobbing process with particular reference to Muir & Melloy patent hobbing machine. Abstract of paper read before Northwestern Branch of I.M.E.

REFRIGERANTS

Hydrocarbon. Some Properties of Hydro-Carbon Refrigerants, H. D Edwards. A.S.R.E. Jl. vol. 8, no. 6, May 1922, pp. 488-495, 5 figs. Discusses use of butane, propane, ethane, and makes comparison with ammonia.

REFRIGERATING PLANTS

Steam vs. Electric Drive. A Few Facts About Steam- and Electric-Driven Refrigerating Plants, C. E. Porce. Power, vol. 55, no. 22, May 30, 1922, pp. 855-856. Comparison of electric motors and other prime movers.

REFRIGERATION

Insulation, Thickness of. The Economic Thickness of Insulation in the Refrigerating Field, P. Nicholls. Am. Soc. Heat. & Vent. Engrs. Jl., vol. 28, no. 3, Apr. 1922, pp. 343-358, 6 figs. Various items of monetary expense which leakage of heat causes and formulas which include all definite expense factors.

RELAYS

PROTECTIVE. Relay Protection for Electrical Apparatus in Western Use, C. H. Bragg, [illegible] & West Industry, vol. 48, no. 10, May 15, 1922, pp. 402-405, 9 figs. Discussion of special problems of western irrigation pumping installations, latest schemes of relay connections, recent developments in relays and operating experienced with existing relay systems.

RIVERS

CANALIZATION OF ST. LAWRENCE. An Examination of the Plan for Canalizing the St. Lawrence River, Wilfred H. Schoff. Engrs. & Eng., vol. 1, no. 3, Mar. 1922, pp. 85-89. Author concludes that as economical investment in combined power and navigation it is not desirable. Better to develop each separately.

COLORADO. Controlling the Principal Artery of the Southwest States, C. E. Grunsky. [illegible] & West Industry, vol. 48, no. 9, May 1, 1922, pp. 348-350, 4 figs. Discusses feasibility of construction of dam that would rise to height of 550 ft., storing 25,000,000 acre-ft. of water which will irrigate thousands of acres of and land, protect Imperial Valley from disastrous floods and generate approximately 600,000 hp. of electrical energy.

ROAD CONSTRUCTION

TRUCK OVERLOADS. Truck Overloads and Road-Building, J. G. McKay. Power Wagon, vol. 28, no. 210, May 1922, pp. 25-28. Importance of having roads meet traffic demands. Analysis of over loading and cause of traffic increase.

ROADS

OIL SPECIFICATIONS, ILLINOIS. Illinois Prepares New Road Oil Specifications, H. F. Clemmer. Good Roads, vol. 62, no. 20, May 17, 1922, pp. 280-281. Requirements resulting from experimentation in the laboratory Division of Highways.

ROADS, CONCRETE

FRACTURES. Fractures in Concrete, Harry Bentham. Surveyor, vol. 61, no. 1577, Apr. 7, 1922, pp. 289-290. Account of author's experience in reconstruction of thoroughfare to meet requirements of present day fast and heavy traffic. Fractures thought to be due to expansion and contraction in bulk. (Abstract.) Paper read before British Soc. of Engrs.

PROPER AGGREGATE. Proper Aggregate for Concrete Roads, Duff A. Abrams. Contract Rec. vol. 36, no. 19, May 10, 1922, pp. 417-421. General requirements for highway work. Tests for stone and sand that aid in selection of suitable material for best results.

ROLLING MILLS

COLD-ROLLING STRIP. New Five-Stand Cold-Rolling Strip Mill. Iron Age, vol. 109, no. 19, May 11, 1922, pp. 1289-1291, 5 figs. Tandem mill of new design has unusual flexibility of control; electric power a feature.

CONTINUOUS. Development of Continuous Rolling Mills, John W. Sheperdson. Iron Age, vol. 109, nos. 11, 15 and 17, Mar. 23, Apr. 13 and 27, 1922, pp. 791-794, 993-995 and 1149-1151, 15 figs. Design affected by fundamental conditions specific problems, and co-relation of units. Merchant mills not well adapted to continuous principle. Selection of cooling-bed length; staggering of mills. Paper read before Engrs'. Soc. West. Pa.

ELECTRIFICATION PROGRESS. Mill Electrification Progresses, Wilfred Sykes. Iron Trade Rev., vol. 70, no. 22, June 1, 1922, pp. 1550-1554, 1 fig. Recent years have witnessed number of large installations of motor drives on rolling mills; operation results are satisfactory; power and motor size not limited; general plant layout discussed. From paper read before Am. Iron & Steel Inst.

HOT BILLET SCRAPER. An Automatic Hot Billet Scraper, R. C. Rohrabacher. Iron Age, vol. 109, no. 17, Apr. 27, 1922, pp. 1126-1128, 6 figs. Mechanical device for removing defects in use in Canadian rolling mills. Advantages and savings.

STRIP MILLS. New Continuous Ten-Stand Strip mill, Iron Age, vol. 109, no. 22, June 1, 1922, pp. 1510-1512, 3 figs. Compact unit designed for heavy production; interesting details of electric drive; arrangement at Trumbull Steel Co.

WROUGHT-IRON BARS, ROLLING. Power Required to Roll Wrought Iron Bars, Edwin L. Fletcher. Iron Age, vol. 109, no. 17, Apr. 27, 1922, p. 1144. Results of tests in reducing [illegible] billets to [illegible] in rounds.

ROPE

FLEXIBLE STEEL. Making and Care of Flexible Steel Ropes, W. Voigtlander. Iron Age, vol. 109, no. 16, Apr. 20, 1922, pp. 1065-1066, 1 fig. Operation of standing machines; securing open ends of rope; effective strength with some wires broken.

WIRE, FLEXIBLE. Making and Care of Flexible Steel Ropes, W. Voigtlander. Eng. & Indus. Management, vol. 7, no. 15, June 1, 1922, pp. 463-465. Description of three steps in manufacture, lubrication and inspection when in use. Based on paper read before Assn. Iron & Steel Elec. Engrs.

S

SAFETY

ELECTRICITY IN FACTORIES. Electricity and Safety First in Factories, W. H. Seal. Electrician, vol. 88, no. 2297, May 26, 1922, pp. 618-623, 4 figs. Suggests code of safety rules; precautions desirable in using electrical machinery.

SAWS

WIRE, FOR SLATE AND MARBLE. Wire Saws for Slate and Marble Cutting. Quarry, vol. 27, no. 303, May 1922, pp. 181-183, 4 figs. Description of this kind of saw [illegible]

SCRAP

[illegible] Reclaiming Railroad Scrap Pile, Edward K. Hammond. Machy. (N.Y.), vol. 28, no. 10, June 1922, pp. 769-772, 8 figs. Conversion into useful articles of much material found in scrap piles. How Can. Pacific turns its scrap pipe into source of revenue.

SHEET METAL [illegible] Metal Scrap (Das Entzinnen von Meissblechabfallen), B. Haas. Metall-Technit, vol. 48, no. 17, Apr. 22, 1922, pp. 17[illegible] [illegible] processes, their [illegible]

SCREW THREADS

[illegible] Screw Thread Inspection by Optical Projection, Ralph E. Flanders. Automotive Industries, vol. 46, no. 21, May 25, 1922, pp. 1116-1119, 7 figs. Speed and accuracy attained by Hart- [illegible] locate imperfect edges of gear teeth by tracing outline of median tooth section. Paper presented before Am. Gear Mfrs. Assn.

SCREWS

MACHINE BOLTS AND. Designing Machine Screws and Bolts, L. T. Rutledge. Can. Machy. vol. 27, nos. 8 and 10, Feb. 23 and Mar. 9, 1922, pp. 26-27 and 24-25 and 29, 6 figs. Feb. 23: Various thread shapes and their respective uses; screw thread as a power medium; thrust factor depending on shape; safety of bolts; pipe threads. Mar. 9: Screw threads for bolts and nuts. Bending stresses; stripping of threads; failure due to shear; lacking deviees; effect of vibration; etc.

MILLING. The Milling of Screws, H. H. Jeffcott. Engineering, vol. 113, no. 2936, Apr. 7, 1922, pp. 441-442, 5 figs. Account of problems of interest to manufacturer and meteologist. Paper read before (British) Instn. Mech. Engrs.

SEMI-DIESEL ENGINES

OPERATION. Semi-Diesel Engines (Les Moteurs Semi-Diesel). Technique Moderne, vol. 14, no. 4, Apr. 1922, pp. 145-150, 31 figs. Construction and operation, fuel injection, regulation and general application.

WATER INJECTION IN. The Use of Water Injection in Semi-Diesel Oil Engines, R. B. White. Power, vol. 55, no. 16, Apr. 18, 1922, pp. 617-618. Author claims that while water injection is necessary in low-pressure engines, it is not desirable and may be avoided by higher compressions; and that water does free cylinder of carbon, and its occasional use is recommended, even in dry engines.

SEWAGE DISPOSAL

ACTIVATED SLUDGE. Activated Sludge Plant at Brampton, Ontario, W. M. Threadgold. Can. Engr., vol. 42, no. 19, May 9, 1922, pp. 459-461, 4 figs. Sedimentation tanks reconstructed for new system. Capacity 300,000 gal. per day; four-hour aeration period; diffusion ratio 4.8; sludge dewatered in tank; used as fertilizer; troubles overcome.

SEWERS

COEFFICIENT OF FRICTION. On the Proper Value of Kutter's for Sewer Computations, Chas. W. Sherman. Eng. New-Rec., vol. 88, no. 23, June 8, 1922, pp. 948-950. Existing data based on actual sewer conditions scanty; overlooked federal bulletins; suggestion for.

VANCOUVER DISTRICT. Three Million Dollars Spent on Sewer Schemes for Vancouver District, Contract Rec., vol. 36, no. 21, May 24, 1922, pp. 485-488, 4 figs. Review of progress made to date by Vancouver and districts joint sewerage and drainage board in development of comprehensive sewer layout.

SHEARS

HYDROELECTRIC BLOOM. Hydro-Electric Bloom Shear, Iron Age, vol. 109, no. 16, Apr. 20, 1922, pp. 1078-1079, 4 figs. New method of operation devised for use in mills without steam power.

SNOW REMOVAL

CRANE CARS. Crane Cars Solve Snow-Removal Problem. Elec. Ry. Jl., vol. 59, no. 20, May 20, 1922, pp. 825-827, 5 figs. Three crane cars designed by Third Ave. Ry., New York City, for general track repair and handling and transportation of miscellaneous materials have been used to increase snow-fighting equipment by addition of wings.

SOUND WAVES

SUBMARINE. Propagation of Sound Waves and the Phenomena of Submarine-Listening (Etude sur la propagation des ondes acoustiques et les phénomènes d'écoute à sous-marine), H. Brillie, Bul. Technique du Bureau Veritas, vol. 3, no. 12, Dec. 1921, and vol. 4, nos. 1, 2 and 3, Jan., Feb. and Mar. 1922, pp. 302-305, 15-21, 39-42 and 68-72, 23 figs. Dec.: Propagation of waves and their reflection; maximum amplitude of waves resulting from combination of several waves. Jan.: Transmission of acoustic waves between three mediums; resonance and its use in selection of sounds. Feb.: Propagation of waves in listening tubes and combination of waves. Mar.: Theory and application of stethoscopes

SPRINGS

AUTOMOBILE. *See Automobiles, Suspension.*

LEAF, MODERN MANUFACTURE. Modern Methods of Making Leaf Springs, E. F. Lake. Iron Age, vol. 109, no. 20, May 18, 1922, pp. 1343-1346, 6 figs. Mechanical forming machines; tempering furnaces; assembling, testing and inspecting.

STANDARDS

BRITISH AUTOMOBILE DRIVING LAMPS. Disc for Determining the Illuminating Effect of Automobile Driving Lamps, British Eng. Standards Assn., Jan. 1922, no. 151, 9 pp. 2 figs.

BRITISH, RAIL TESTING MACHINES. Falling Weight Testing Machines for Rails. British Eng. Standards Assn., Apr. 1922, no. 103, 1 p.

U. S. BUREAU OF STANDARDS. What the Bureau of Standards Can Do for You. Factory, vol. 28, no. 5, May 1922, pp. 540-541 and 554, 556 and 558, 3 figs. Indicates scope of service.

STEAM

CONSUMPTION, CALCULATION. Steam Consumption Accounted For by Indicator Diagram. Power, vol. 55, no. 24, June 13, 1922, pp. 935-937, 7 figs. Development of equations for water rate and application to indicator diagram giving steam, that would be used if no condensation occurred.

PRODUCTION. Economics in Steam-Raising, T. W. Harper. Gas Jl., vol. 158, no. 3075, Apr. 19, 1922, pp. 154-156. Lancashire versus water-tube boilers; boiler settings and flues; feedwater and scale; fuel and grate; waste heat utilisation; superheaters; steam distribution. Paper read before North British Assn. Gas Managers.

PRODUCTION AND USE. Production and Use of Steam (Production et utilisation de la vapeur), Victor Kammerer. Bul. de la Société Industrielle de Mulhouse, vol. 87, no. 9, Nov. 1921, pp. 440-464. Discusses fuel, efficiency and losses, automatic stokers, etc.

PRODUCTION AND UTILIZATION. Work of the Fuel Utilization Commission, V. Kammerer (Travaux de la Commission d'Utilisation du Combustible). Bul. de la Société d'Encouragement pour l'Industrie Nationale, vol. 134, no. 1, Jan. 1922, pp. 50-78. Report on production and utilization of steam, including transmission, motive power, use of steam for manufacturing and heating purposes, etc. See also Chaleur et Industrie, no. 24, Apr. 1922, pp. 1175-1182.

STEAM ENGINES

Extraction. Possibilities of the Extraction Engine. Iron & Coal Trades Rev., vol 104, no 2825, Apr 21, 1922, pp 567-568, 2 figs. Describes a steam-extraction engine built by John Musgrave & Sons, Ltd., Bolton, Eng., of 650 i.hp. at 160 r.p.m. for maximum extracted steam quantity of about 11,000 lb. per hr. at from 10 to 15 lb. receiver pressure, drives line shafting by ropes, and is direct-coupled to a 200-kw. d.c. generator.

STEAM POWER PLANTS

Battle Creek. Battle Creek Steam Plant of Consumers Power Company, W. W. Tefft. Power, vol. 55, no. 23, June 6, 1922, pp. 880-885, 6 figs. Plant capacity of 27,500 kw.; modern boiler installation with large boilers to operate at high capacity; combined evaporative efficiency of boilers, water backs, superheaters and economizers of 85 per cent on test, and average under load for January of 80 per cent; other outstanding features.

STEAM TURBINES

Reliability and Design. Steam Turbine Reliability and Design. Engineer, vol. 133, no. 3462, May 5, 1922, pp. 486-487, 1 fig. Particular considerations are reliability, economy and first cost.

Starting Up. Putting Steam Turbines in Service. Power, vol. 55, no. 20, May 16, 1922, pp. 756-759, 4 figs. Increasing size of units makes procedure of starting more serious. Features to look out for.

STEEL

Carburizing. Influence of Dissolved Oxides on Carburizing and Hardening Qualities of Steel, E. W. Ehn, Iron & Steel Institute, Advance Paper no. 5, Meeting May 1922, 39 pp., 32 figs. Tests showing that steels of similar chemical composition do not respond similarly to case-hardening operations due to non-metallic impurities in solid solutions.

Chromium. *See Chromium Steel.*

Fracture Test. Fracture Test on Steel to Determine Its Quality, W. J. Priestley. Am. Soc. for Steel Treating Trans., vol. 2, no. 7, Apr. 1922, pp. 620-622, 2 figs. Saw disk about 1 ¼ in. thick from end of forging or bloom; quench slightly above critical temperature, draw between 900 and 1100 deg. fahr., and break in two. Fracture parallel to direction of forging or rolling will disclose texture of metal. Flake, slag, blowholes and pipe are easily detected.

Heat Treatment of. On the Stepped A1 Transformation in Carbon Steel During A Rapid Cooling, K. Honda and T. Kikuta. Iron & Steel Inst., advance paper, no. 8, meeting, May 1922, 13 pp., 13 figs. Experiment and discussion of effect of rapid cooling on A1 transformation point.

Rivet, Effect of Sulphur on. Effect of Sulphur on Rivet Steel, E. E. Thum. Chem & Mt. Eng., vol. 26, no. 22, May 31, 1922, pp. 1019-1024, 15 figs. Maximum sulphur now allowed (0.045 per cent) is at least 0.01 per cent below quantity where sulphur will damage strength of well-made rivet steel as far as its performance can be predicted by standard tests.

Stainless. Stainless Steel and Rustless Iron, Herbert Whitaker. Ironmonger, vol. 175, no. 2530, May 13, 1922, p. 106. Rustless iron, rustproofing cast iron and steel, formation of magnetic oxide.

Stainless Steels and the Making of Cutlery, R. G. Hall. Am. Soc. for Steel Treating Trans., vol. 2, no. 7, Apr. 1922, pp. 561-565 and (discussion) 566-568, 6 figs. Manufacture of stainless steel blade, while not materially different in shape or size from that of ordinary carbon steel blade, is shown to be a great deal more costly.

Crystal Structure, X-Ray Studies. X-Ray Studies on Crystal Structure of Steel, A. Westgren and G. Phragmen, Iron & Steel Inst., advance paper, No. 11, Meeting, May 1922, 22 pp., 12 figs. Crystallographic investigations of iron and steel carried on with improved apparatus obtaining results hitherto lost.

Decarburisation by Hydrogen. Hydrogen Decarburisation of Carbon Steels with Considerations on Related Phenomena, Chas. R. Austin, Iron & Steel Inst., Advance Paper, No. 1, Meeting, May 1922, 50 pp., 40 figs. Removal of carbon from certain fairly pure carbon steels by hydrogen at normal pressure and varying temperatures. See also Iron & Coal Trade Rev., vol. 104, no. 2827, May 5, 1922, p. 661.

STEEL, HEAT TREATMENT OF

Abrasive Qualities, Effect on. The Abrasive Qualities of Plain Carbon and Alloys Steels, A. M. Cox. Am. Soc. for Steel Treating Trans., vol. 2, no. 8, May 1922, pp. 680-690, 12 figs. Results of tests on effect of heat treatment on abrasive qualities of plain carbon and alloy steels, after having been subjected to various heat treatments.

Annealing. A New Annealing Process for Sub-Pearlite Steels (Ein neues Glühverfahren für unterperlitische Stähle), Bengt Kjerrman. Stahl u. Eisen, vol. 42, no. 18, May 4, 1922, pp. 697-700, 3 figs. Annealing of steel to increase its workability by means of cutting tools.

Chrome Steel for Ball Bearings. Heat Treatment of Chrome Steel for Ball Bearings, Haakon Styri. Am. Soc. for Steel Treating Trans., vol. 2, no. 8, May 1922, pp. 718-729, 34 figs. Metallography and important features of process.

Heating and Cooling. Importance of the Proper Heating and Cooling of Steel, John A. Succop. Am. Soc. for Steel Treating Trans., vol. 2, no. 8, May 1922, pp. 673-679, 4 figs. Vital points in this process including temperature, time, surface and mass.

Magnetic Properties, Influence on. The Influence of Heat Treatment Upon the Magnetic Properties of Steel, Lancelot W. Wild. Am. Soc. for Steel Treating Trans., vol. 2, no. 8, May 1922, pp. 696-704, 6 figs. Intensity of Magnetization, permeability, residual induction, and coercive force. Bibliography.

STEEL, HIGH-SPEED

Physical Tests. Physical Tests on High Speed Steels, A. H. d'Arcambal. Am. Soc. for Steel Treating Trans., vol. 2, no. 7, Apr. 1922, pp. 586-595 and (discussion) 595-601, 33 figs. Results of series of tensile and transverse tests on two classes of high-speed steel, namely 18-per cent tungsten, 1-per cent vanadium type and the 14-percent tungsten, 2-per cent vanadium grade.

STEEL MANUFACTURE

Acid Open-Hearth Process. Fine Steels from the Acid Open Hearth, W. P. Barba and Henry M. Howe. Chem. & Met. Eng., vol. 26, no. 20, May 17, 1922, pp. 929-931, 1 fig. Discussion of underlying principles and necessary furnace practice for production of high-grade nickel steel for gun tubes and shafting. Comparison of pig, scrap, and ore processes used in America with all-scrap practice used in Europe. Digest of paper presented before Am. Inst. Min. & Met. Engrs.

Acid, Analysis. Analysis Aids Acid Steelmaking, A. C. Jones. Iron Trade Rev., vol. 70, no. 24, June 15, 1922, pp. 1720-1722. Operating schedule and discussion of elements entering into electric furnace process; desirability of accurate control; melter's ability.

Direct Process. A Direct Method of Steel Manufacture, A. E. Bourcoud. Iron Age, vol. 109, no. 20, May 18, 1922, pp. 1349-1351, 3 figs. Discussion of Bourcoud process and possibility of using oil, lignites and other fuels; data on costs. (Abstract). Paper presented at meeting of Am. Iron and Steel Inst.

Tropenas Converter. Tropenas Converter for Making Steel, S. R. Robinson. Blast Furnace & Steel Plant, vol. 10, no. 5, May 1922, pp. 282-284. General description of this process, details of converter and information regarding cupola change. This process very similar to Bessemer process.

STEEL WORKS

Electric, Adaptable. An Adaptable Electric Steel Company, Sidney G. Koon. Iron Age, vol. 109, no. 18, May 4, 1922, pp. 1196-1202, 10 figs. Two forging plants of different characteristics afford opportunity for handling in each work to which it is best fitted.

STOKERS

Developments. Topical Discussion: Stokers and Their Recent Developments. Assn. Iron & Steel Elec. Engrs., vol. 4, no. 4, Apr. 1922, pp. 163-211. Various notable features brought out by men prominent in industry.

Forced-Draft. Some Notes on the Construction and Operation of Coxe Stokers, John van Brunt. Am. Soc. Heating & Vent. Engrs. Jl., vol. 28, no. 3, Apr 1922, pp. 298-308 and (discussion) 308-310, 8 figs. History of development, details of present type, and notes on operation.

Selection. What to Know When Selecting Stoker Equipment, J. G. Worker. Power, vol. 55, no. 17, Apr. 25, 1922, pp. 647-650. Combustion characteristics of principal coals; types of stokers best suited to burn them.

STORAGE BATTERIES

Impurities, Effect of. A Study of Effect of Impurities on Storage Batteries, Helen C. Gillette. Am. Electrochem. Soc. advance paper, no. 7, for meeting Apr. 27-29, 1922, pp. 55-62. Effect of presence of certain amounts of impurities in electrolyte of storage cell on electrical performance of cell. Comparison of electrical characteristics of cells before and after contamination and with normal cells included in same series of tests.

STREET RAILWAYS

Quebec. Quebec's Railways and Their Power Supply. Elec. Ry. Jl., vol. 59, no. 21, May 27, 1922, pp. 855-858, 9 figs. Growth of local transportation has more than kept pace with that of population. In 25 yrs., while population has doubled, car-mileage has more than quadrupled, number of passengers carried has sextupled and gross earnings have octupled.

Toronto's Rolling Stock. Toronto's Progressive Rolling Stock. Elec. Ry. Jl., vol. 59, no. 21, May 27, 1922, pp. 867-870, 10 figs. Toronto Transportation Commission has added 250 new cars to its passenger rolling stock and has remodeled more than 350 other cars.

Turnstile Cars. Improvement in Turnstile Cars. Elec. Ry. Jl., vol. 59, no. 19, May 13, 1922, pp. 787-789, 6 figs. One-man operation with double-truck cars in Utica and Syracuse has increased steadily until now Utica has 100 per cent operation. Improvements in turnstile arrangement are described.

STRUCTURAL STEEL

Testing. The Blow Bending Strength and Blow Hardness of Structural Steel (Schlagbiegefestigkeit und Schlaghärte legierter Konstruktionsstähle), W. Müller. Forschungsarbeiten auf dem Gebiete des Ingenieurinesins, no. 247, 1922, 38 pp., 74 figs. partly on supp. plate. Describes tests steel and method of carrying out experiments; results of breaking tests, bending tests, hardness tests; connection between mechanical properties and alloying of steels.

STRUCTURES

Mechanical Analysis. Indeterminate Structures Mechanically Analyzed, G. E. Beggs. Eng. and Contracting, vol. 57, no. 21, May 24, 1922, pp. 497-501, 16 figs. Results by mechanical method give remarkable check with theory and provide great reduction in labour. Tests with paper and celluloid models of various structures described in detail.

Statically Indeterminate and Non-Articulated. Statically Indeterminate and Non-Articulated Structures, F. C. Lea. Engineering, vol. 113, nos. 2933, 2934, 2935 and 2938, Mar. 17, 24, 31 and Apr. 21, 1922, pp. 313-315, 351-352, 403-404 and 482, 15 figs. Writer seeks to show how number of important practical problems can be solved by application of two theorems known as Castigliano's theorems, and "principle of least work" which can be said to be special case of these theorems.

SUBSTATIONS

Montreal. New Power Distribution Centre for Montreal. Elec. Ry. Jl., vol. 59, no. 21, May 27, 1922, pp. 861-866, 6 figs. Cote Street Substation, recently constructed at load center of tramways system, will serve as power distribution headquarters; rotary converters used rather than motor-generator sets installed in several other substations of system.

SULPHURIC ACID

Fumes. Atmospheric Pollution from Sulphuric Acid Plant Fumes, James R. Withrow. Chem. & Met. Eng., vol. 26, no. 21, May 24, 1922, pp. 972-976. Discussion of importance of fume problem to chemical manufacturer from standpoint of public health, legislation and economical operation. Work of Atmospheric Pollution Committee of Am. Inst. Chem. Engrs.

SUPERHEATED STEAM

Temperature Measurement. Measurement of Superheat, B. O. Snyder. Power Plant Eng., vol. 26, no. 10, May 15, 1922, pp. 515-516, 2 figs. Types of thermometers used; precautions in taking readings; making corrections.

SUPERHEATERS

Design. Advantages and Calculation of Size of Superheaters As Well As Flue Gas and Waste Steam Preheaters (Vorteile und Grössenberechnung von Dampfüberhitzer sowie Rauchgas- und Abdampfvorwärmer). Wärme- und Kälte-Technik, vol. 24, no. 9, May 1, 1922, pp. 101-102. Mainly deals with superheaters.

SURVEYING

Aerial. Surveying from the Air, E. Lester Jones. Franklin Inst. Jl., vol. 193, no. 4, Apr. 1922, pp. 461-490, 11 figs. Aerial mapping problems; Atlantic City project; topographic revision of coast of New Jersey; Mississippi River Delta; experiments in under-water photography.

SWITCHGEAR

High-Voltage. High Voltage Switchgear Design, W. A. Coates. Electrician, vol. 88, nos. 2294 and 2295, May 5 and 12, 1922, pp. 526-530 and 556-559, 9 figs. Details of modern outdoor switchgear compared with indoor equipment, pointing out economic and engineering advantages.

T

TAPERS

STANDARDIZATION. Shall We Standardize Tapers? Am. Mach., vol. 56, nos. 15, 16 and 17, Apr. 13, 20 and 27, 1922. pp. 551-552, 595-597 and 627-629. Opinions of many firms making and using tapered members. Nearly all want a standard.

TAR

DISTILLATION. New Tar Distillation Process. Chem. Trade Jl. & Chem. Engr., vol. 60, no. 1827, May 26, 1922, p. 628. Industrial application of volatilization of steam removes some difficulties previously encountered.

TELEPHONY

TELECHRONOMETER. A New "Universal Service", Garrison Babcock. Telephone Engr., vol. 26, no. 5, May 1922, pp. 21-24, 7 fig. Semi-automatic system adopted by Everett, Wash. said to have increased service, economy and clientele.

TEMPERATURE MEASUREMENT

ACCURACY. Accuracy in Temperature Measurements, Horace C. Knerr. Forging & Heat Treating vol. 8, no. 5, May 1922, pp. 235-237. Accuracy essential because of variations in steel; potentiometer pyrometers recommended; cold junction compensation; remarks on thermocouples with reference to standardization.

TESTING MACHINES

COMPARING HARDNESS, FOR. Apparatus for Comparing the Hardness of Pitches and Bitumens. Engineer, vol. 133, no. 3456, Mar. 24 1922, pp. 338-339, 2 figs. Describes the Hall-Marriott automatic penetrometer, designed to exclude human element in determination of consistency of plastic substances used in road construction.

TINNING

HOT TINNING. Hot Tinning, S. R. Gerber. Metal Industry (Lond.), vol. 20, nos. 16 and 17, Apr. 21 and 28, 1922, pp. 369-371 and 396, 2 figs. Description of reorganization of department for tinning steel cans.

TIRES, RUBBER

CORD. The Superiority of Cord Tires, C. M. Gautier. India-Rubber Jl., vol. 63, no. 18, May 6, 1922, pp. 7-8, 4 figs. Superiority of this type shown by experiments with appliances which subject tires to conditions actually met in service.

TITANIUM OXIDE

PRODUCTION AND USE. Production and Use of Titanium Oxide, Noel Heaton. Chem. Trade Jl. chem. Engr. vol. 70, no. 1825, May 12, 1922, pp. 565-566. Discussion of development, manufacturing processes, chemical and physical properties and uses. Read before Royal Soc. of Arts.

TOOLS

CALCULATION OF CIRCULAR. The Calculation of Circular Form-Tools. An Empirical Formula. Mech. World, vol. 71, no. 1847, May 26, 1922, pp. 375-376, 4 figs. Development of simplified empirical formula, circular form tools.

RING. The Economical Design of Ring Tools. H. Baker. Machy. (Lond.), vol. 20, no. 504, May 25, 1922, pp. 236-238, 2 figs. Formulas for figuring labor costs in consideration of circular form tool.

TRACTORS

TESTING, STANDARD CODE FOR. Standard Code for Testing Tractors. Agricultural Eng., vol. 3, no. 5, May 1922, pp. 82-83 (includes discussion). Report of Subcommittee on Tractor Ratings presented at annual meeting of Agricultural Engrs.

TRANSFORMERS

OPEN-DELTA ARRANGEMENT. Economy of Open-Delta Operation, Merrill de Merit. Elec. World, vol. 79, no. 16, Apr. 22, 1922, pp. 774-776, 3 figs. In growing industries, it is claimed, two transformers may serve load for some time, thus postponing purchase of one transformer. Condition when third unit is necessary.

TUBES

AUTOMATIC SEAM WELDING. Automatic Seam Welding and the Manufacture of Tubes, J. L. Anderson. Am. Welding Soc. Jl., vol. 1, no. 3, Mar. 1922, pp. 26-34, 1 fig. Describes simple process which makes possible production of this class of tubing at fraction of cost of seamless steel tubing.

SEAM WELDING, AUTOMATIC. Automatic Seam Welding in Making of Tubes. J. L. Anderson. Can. Machy., vol. 27, no. 21, May 25, 1922, p. 31. Material must be of suitable composition; finger arrangement prevents all twist or curl when strip stock is entering rolls, compressing metal after weld is made.

TUNNELS

HUDSON RIVER. Involves Iron and Steel Tonnage. Iron Trade Rev. vol. 70, no. 18, May 4, 1922, pp. 1263-1265, 3 figs. Hudson River tunnel project for which contracts recently were awarded, introduces new engineering problems and requires many thousands tons of castings, structural steel, bolts, pipe, reinforced steel, etc.

TURBO-GENERATORS

PROTECTIVE APPARATUS. Protective Apparatus for Turbo-Generators, J. A. Kuyser. Electrician, vol. 88, no. 2294, May 5, 1922, pp. 531-532, 1 fig. Discussion of breakdowns. Old methods of preventing damage and improved new system. Automatic field switches and means of extinguishing fires. (Abstract.) Paper read before Inst. of Elec. Engrs.

V

VALVES

EMERGENCY CLOSING. Emergency Closing Valves, P. W. Knauf. Refrig. World, [illegible] 1922, pp. 22-24, 6 figs. Necessity for and types of valve [illegible] pipes.

GATE, ELECTRICALLY-OPERATED. Electrically Operated Gate Valves, C. E. Reese. [illegible] 1922, pp. 619-622, 10 figs. Discussion [illegible] development of Dean control system for operation of gas, air, steam, water, oil, tar and ammonia gate valves.

VENTURI METERS

[illegible] Tests, [illegible] Venturi Flume and Meter Tests, [illegible] no. 19, May 11, 1922, pp. 797-798, 1 fig. Discussion of peculiar variations of Venturi coefficients of discharge. Wave formation, air and other theories.

VIADUCTS

REINFORCED-CONCRETE. North Avenue Viaduct, Milwaukee. Pub. Works, vol. [illegible] and 17, Apr. [illegible] 4 figs., Apr. [illegible] contractor's [illegible] Apr. 29; [illegible]

VIBRATIONS

MEASUREMENT. Apparatus for Studying the Vibrations Produced in Building by the Traffic (Appareil destiné à l'étude des vibrations produites dans les édifices par la circulation des véhicules), Paul Prache. Bul. de la Société d'Encouragement pour l'Industrie Nationale, vol. 134, no. 3, Mar. 1922, pp. 177-186, 7 figs. Holds that a disagreeable element is acceleration and describes principle and operation of accelerometer for measuring vibrations.

VOLTAGE REGULATION

THREE-WIRE D. C. SYSTEM. A Method of Regulating the Voltages on the Two Sides of a Three-Wire D.C. System Equalized by Static Balancers, R. D. Archibald. Instn. Elec. Engrs. Jl., vol. 60, no. 307, Mar. 1922, pp. 303-307, 7 figs. Compares merits of static balancer with those of rotary balancers, chief disadvantage of former being that voltage on two sides of three-wire system cannot be regulated without aid of mid-wire booster. Describes arrangement whereby this disadvantage can be overcome.

W

WAGES

PAYMENT PLANS. Wage-Payment Plans — A Discussion, Harrington Emerson. Management Eng., vol. 2, no. 6, June 1922, pp. 370-372, 1 fig. Exposition of six plans of payment with some detail of author's plan.

WATER

ANALYSIS. Processes of Analyzing Water (Sur les procédés d'analyse des eaux), F. Touplain. Chimie & Industrie, vol. 7, no. 4, Apr. 1922, pp. 634-639, 3 figs. Discusses sampling, physical and chemical methods; concludes that present methods need revising.

WATER FILTRATION

FERRIC ALUMINUM COAGULATION. Manufacture of Ferric Aluminum in the National Sanitary Works (La fabricación del alùmino ferrico en las obras sanitarias de la nacion), S. Barabino. Anales de la Sociedad Cientifica Argentina, vol. 91, Jan.-June 1921, pp. 152-182. Report of a commission appointed to investigate works in question, "ferric aluminum" being used for clarification of potable water, 0.04 g. being required to clarify 1 liter of Plata water.

HYDROGEN-ION CONCENTRATION. Applied Hydrogen-Ion Concentration — A Study of Its Merits in Practical Filter Plant Operation, A. Wagner and Lin H. Enslow. Am. Water Works Assn. Jl., vol. 9, no. 3, May 1922, 373-391, 1 fig. on Supp. splate. Ideas on coagulation through regulation.

WATER PIPES

SIZES. Water Pipe Sizes for Plumbing Fixtures, Branches and Mains, W. S. Timmis, Am. Soc. Heat. & Vent. Engrs., vol. 28, no. 4, May 1922, pp. 397-403. Discussion of formulas and variables intended to supply a general lack of data.

WATER POWER

APPLICATIONS. Water-Power Applications Total 20,473,548 Hp. Elec. World, vol. 79, no. 21, May 27, 1922, pp. 1072-1073, 1 fig. Federal power commission has received 303 applications for preliminary permits and licenses, and of these had granted 74 up to and including April 17, 1922.

DEVELOPMENT IN SOUTHEAST. Power Development in the Southeast, Chas. G. Adsit. Mech. Eng., vol. 44, no. 5, May 1922, pp. 291-294, 300, 5 figs. Utilized and undeveloped waterpower resources of 5 southern states discussed. Present state of Muscle Shoals project and future possibilities described.

WATER PURIFICATION

TORONTO 1912-1922. Statistical Record of Toronto Water, 1912-22, Norman J. Howard. Can. Engr. vol. 42, no. 19, May 9, 1922, pp. 469-476, 2 figs. Laboratory observations recorded during 10-year period of purification. Relation of hydrogen-ion concentration to residual alum; bacterial concentration and seasonal variation in filter efficiency, with reference to PH concentration and colloidal content; reduction in typhoid fever.

WATER SUPPLY

SEWAGE CONTAMINATION, PREVENTION FROM. The Work of the Provincial Board of Health of Ontario, F. A. Dallyn. Contract Rec., vol. 36, no. 21, May 24, 1922, pp. 493-497. What Board is doing to protect various water works throughout province from sewage contamination; research activities.

WELDING

BOILERS. Boiler Welding, Edward H. Heigel. Am. Welding Soc. Jl., vol. 1, no. 3 Mar. 1922, pp. 13-25, 20 figs. Notes on autogenous welding of locomotive boilers; electric or gas welding of firebox, side and door sheets, door collars, stoker tubes, etc; electric welding of flexible sleeves; cutting of staybolts.

See also Autogenous Welding, Electric Welding, Oxy-Acetylen Welding.

WELDS

CAST-IRON, DEPENDABILITY OF. The Dependability of Cast Iron Welding, G. O. Carter. Acetylene Jl., vol. 23, no. 11, May 1922, pp. 535-538, 8 figs. Pre-heating and annealing; correct preparation of casting, by having complete casting at red temperature. From paper read before Am. Welding Soc.

TESTING STANDARDS. Standards for Testing Welds. Eng. World, vol. 20, no. 5, May 1922, pp. 297-300, 13 figs. Report of Committee on Standards Tests for Welds of Am. Bureau of Welding, a joint advisory board of Am. Welding Soc. and Eng. Div. of Nat. Research Council, on Welding Research and Standardization.

WHEELS

CAR. *See Car Wheels.*

WIRE DRAWING

CHROMEL WIRE. Drawing Chromel Wire, E. F. Lake. Machy. (N.Y.), vol. 28, no. 10, June 1922, pp. 793-797, 7 figs. Methods of drawing special alloy wire; uses and physical properties of alloy; manufacture of dies.

Z

ZIRCONIUM

USES. New Possible Uses of Zirconium (Neue Verwendungsmöglichkeiten für Zirkon), Raphael Eugen Kirchner. Chemiker-Zeitung, vol. 46, no. 50, Apr. 27, 1922, p. 380. Discusses zirconium steel, crucibles carbide, etc.

Engineering Index

This Index is prepared by the American Society of Mechanical Engineers.

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A

ACCOUNTING

CONSTRUCTION PROJECTS. Accounting for Construction Projects, W. Paxton Little. Elec. World, vol. 79, no. 24, June 17, 1922, pp. 1211-1215, 18 figs. Commission regulation requirements give importance to proper accounting; actual unit-cost information needed as guide to engineers and executives; outline of specific methods that have been found successful.

AERONAUTICS

GOVERNMENT LABORATORIES AID. Government Laboratories Aid Aircraft Growth, P. M. Heldt. Automotive Industries, vol. 46, no. 26, June 29, 1922, pp. 1423-1426, 3 figs. Aeronautic session of S. A. E. develops discussion on aircraft performance formulas, government subsidies, and commercial flying. McCook field work is shown in motion pictures.

AIR COMPRESSORS

CENTRIFUGAL. A New Air Compressor (Ein Neuer Luftkompressor), E. Löwenstein. Deutsche Optische Wochenschrift, vol. 8, no. 22, May 28, 1922, pp. 413-414, 4 figs. Describes new compressor by Gotz, having very high efficiency and requiring little power, for use in glass-blowing and technical glass industries.

AIRCRAFT

RESEARCH IN AMERICA. America Makes Creditable Showing in Aircraft Research, Archibald Black. Automotive Industries, vol. 46, no. 23, June 8, 1922, pp. 1257-1265, 13 figs. Speed and reliability increased; helicopters; variable pitch propeller; landing field development; Handley Page slotted wing.

AIRPLANE ENGINES

DEVELOPING, METHOD OF. A Method of Developing Aircraft Engines, Geo. E. A. Hallett. Soc. Automotive Engrs. Jl., vol. 10, no. 6, June 1922, pp. 457-462, 10 figs. Outline of procedure taken by Air Service before beginning actual design, and subsequent developments.

METALS FOR. Metallurgical Problems of the Airplane Engine (Le Problème métallurgique posé par le Moteur d'Aviation), C. Grard. Aeronautique, vol. 4, no. 46, May 1922, pp. 156-165. Conditions metals must fulfill for construction of airplane engines.

AIRPLANES

SLOTTED-WING THEORY. Theory of the Slotted-Wing, A. Betz. Nat. Advisory Committee for Aeronautics Technica Notes, no. 100, June 1922, 13 pp., 7 figs. Means of varying coefficient of lift, thereby reducing difficulties of taking off and landing and making greater flight speeds possible; suggestions for theories from which formulas may be developed. From Berichte u. Abhandlungen der Wissenschaftlichen Gesellschaft für Lufthahrt, no. 6, Jan., 1922. See also Aerial Age, vol. 15, no. 15, June 26, 1922, pp. 366-368, 6 figs.

TWO-WAY. Introducing the Two-Way Airplane, John B. Flowers. Aviation, vol. 13, no. 1, July 3, 1922, pp. 9-10, 1 fig. Tentative design presented to stimulate thought in this direction and criticism of idea, by well-known aeronautical engineer.

ALIGNMENT CHARTS

ELECTRIC LIGHTING LINES. Alignment Charts, Their Principles and Application to Questions of Calculating Electric Lighting Lines (Fluchtinientafeln, Grundlagen und Anwendungen auf Fragen der Leitungsberechnung und Beleuchtungstechnik), H. Schwerdt. Elektrotechnische Zeit., vol. 43, no. 23, June 8, 1922, pp. 777-781, 8 figs. Explains charts and how to use them.

ELECTRIC MACHINES. Alignment Charts and Their Application in Electric Machine Construction (Die Nomographic und ihre Anwendungen im Elektromaschinenbau), Stritzl. Elektrotechnische Zeit., vol. 43, no. 23, June 8, 1922, pp. 781-782, 4 figs. Discusses as example calculation of magnetic characteristics of a d.c. machine.

ALLOYS

See Aluminum Alloys, Nickel Alloys, Zinc Alloys.

ALUMINUM

COATING WITH. Coating With Aluminum (Les recouvrements par l'aluminium), Léon Guillet. Revue de Métallurgie, vol. 19, no. 5, May 1922, pp. 296-297. Describes various processes and their successful application.

DETERMINATION OF. The Determination of Aluminium by the Phosphate Method, J. E. Clennell. Min. Mag., vol. 26, no. 5, May 1922, pp. 267-271. Brief Summary of experiments at Royal School of Mines on phosphate method of aluminum estimation.

ALUMINUM ALLOYS

ALUMINUM-SILICON. Aluminum-Silicon Alloys and Their Industrial Uses (Les alliages aluminium-silicum et leurs emplois industriels), Leon Cuillet. Revue de Métallurgie, vol. 19, no. 5,, May 1922, pp. 303-310, 15 figs. Reviews development of this type of alloy and discusses new types and their properties.

ALUMINUM-ZINC. A Study of Alloys of Aluminum and Zinc, D. Hanson and Marie L. V. Gayler. Raw Material, vol. 5, no. 5, June 1922, pp. 174-181, 29 figs. Results of experiments on work along this line; effects of age hardening. Paper read before British Inst. of Metals.

LIGHT. Light Aluminum Alloys, Prof. F. C. Lea. Metal Industry, (Lond.), vol. 20, no. 23, June 9, 1922, pp. 533-536, (includes discussions), 2 figs. Effect of various combinations on melting point and characteristics of alloys. From paper read before Inst. of Metals.

MELTING AND POURING. Melting and Pouring Aluminum Alloys. Am. Mach., vol 57, no. 1, July 6, 1922, pp. 1-4. Proper care of furnace; effect of melting and pouring temperatures on castings; how to overcome foundry difficulties.
See also Duralumin.

AMMONIA

CAPACITY TABLE. A Pound of Ammonia, John E. Starr. Refrig. World, vol. 57, no. 6, June 1922, pp. 19-20. Table showing work of a pound of ammonia when heat is received at various temperatures and discharged at various other temperatures.

CHART, BUREAU OF STANDARDS. The New Bureau of Standards Ammonia Chart. Ice & Refrigeration, vol. 62, no. 6, June 1922, pp. 461-464, 2 figs. Historical facts; nature of chart properties of an hydrous ammonia which are represented; characteristic curves to show properties; phases of cycles of operation; some common cycles of operation shown graphically.

DETERMINATION WITHOUT DISTILLATION. Determining Ammonia Without Distillation, A. Sander. Am. Gas. Jl., vol. 116, no. 25, June 24, 1922, pp. 576-577. Method for determining total ammonia in gas liquor without distillation or use of heat. Translated from Gas u Wasserfach, vol. 64, pp. 770-772.

OXIDATION. Some Economic Aspects of Ammonia Oxidation, Guy B. Taylor. Chem. and Met. Eng., vol. 26, no. 26, June 28, 1922, pp. 1217-1219, 1 fig. Cost of concentrating weak nitric acid produced by ammnoia oxidation at present more than offsets advantages due to lower conversion and nitrogen costs; economic study of factors that determine when ammonia can profitably replace saltpeter as source of nitric acid. Paper read before Annual Meeting of Am. Inst. Chem. Engrs.

AMMONIUM NITRATE

MANUFACTURE. The Manufacture of Ammonium Nitrate, E. M. Symmes. Chem. and Met. Eng., vol. 26, no. 23, June 7, 1922, pp. 1069-1074, 5 figs. Description of modern operating practice and considerations affecting design and operation of ammonia stills, scrubbers, condensers, neutralizing tubs, evaporators and crystallizing kettles; use of ammonium nitrate in permissible explosives.

ASBESTOS

AUTOMOTIVE USES. Asbestos — The Mineral's Automotive Uses. Raw Material, vol. 5, no. 5, June 1922, pp. 184-186. Various uses to which this mineral fibre is put in automotive industries.

MILLING OF. A Problem in Crushing. Can. Min. Jl., vol. 43, no. 24, June 16, 1922, pp. 379-380, 1 fig. Saving long fibre; crushing and fiberizing; requirements of crushers; stages of crushing.

SOUTHERN AFRICA. Southern Africa's Coming Industry. So. African Min. and Eng. Jl., vol. 33, no. 1595, Apr. 22, 1922, pp. 1115-1117, 2 figs. Review of recent discoveries and developments; Canadian interests entering field? Expansion of Rhodesian output; occurrences in union; Kaapsche hoop fields; Amianthus mines; an expanding industry.

SUBSTITUTES AND SIMILARITIES. Asbestos Substitutes and Similarities. India-Rubber Jl., vol. 63, no. 23, June 10, 1922, pp. 7-8, 1 fig. Slag wool with its many advantages; spun glass; soapstone; talc; fossil meal and wood pulp.

ASHES

USE FOR REFIRING. Ash Treatment (Ashen-Aufbereitung), F. A. Gruessner. Technische Blätter, vol. 12, nos. 8 and 9, Feb. 25 and Mar. 4, 1922, pp. 81-82 and 89-90, 3 figs. Feb. 25: Discusses processes of preparing ashes for refiring, such as magnetic separation. Mar. 4: Detailed discussion of magnetic separation.

AUTOMOBILE ENGINES

DIESEL TYPE. Small Diesel Type Automotive Engine Now in Production. Automotive Industries, vol. 46, no. 24, June 15, 1922, pp. 1320-1321, 2 figs. Four-cylinder Austrian engine designed to avoid excessive compression and combustion pressures, thus reducing strain on working parts. Hindl engine can be started by means of hand crank and operates at speed of 1150 r.p.m.

LUBRICATION. Oil-Pumping, Geo. A. Round. Soc. Automotive Engrs. Jl., vol. 10, no. 6, June 1922, pp. 509-512, 4 figs. Factors controlling rate of oil consumption; methods of lubrication, including splash and force-feed systems; oil-pumping troubles.

OIL CONSUMPTION. Oil Consumption, A. A. Bull. Soc. Automotive Engrs. Jl., vol. 10, no. 6, June 1922. pp. 513-522, 19 figs. Fundamental factors affecting oil consumption. Methods of testing.

AUTOMOBILE FUELS

ALCOHOL. Alcohol Motor Fuel Research. Petroleum Times, vol. 7, no. 176, May 20, 1922, pp. 711-712. Report of four series of tests which showed that all speeds, both with high and low compression, thermal efficiency obtained with alcohol was higher than that obtainable with petrol or benzol at any compression which could be employed with them.

RESEARCH, EFFECT ON INDUSTRY. Automotive Engineering Development Rests Largely on Fuel Research. Herbert Chase. Automotive Industries, vol. 46, no. 23, June 8, 1922, pp. 1219-1231, 16 figs. Gasoline substitutes used in other countries; cracking processes developed; work of Ricardo and Kettering.

AUTOMOBILE INDUSTRY

RESEARCH IN IRON AND STEEL. Better Cars and Trucks May Result from Iron and Steel Research. P. M. Heldt. Automotive Industries, vol. 46, no. 23, June 8, 1922, p. 1270. Study of chrome-molybdenum steel, high-carbon steel brake drums, resistance-to-wear investigation and heat treatment.

RESEARCH IN LIGHT METALS. Light Metal Research Will Affect Future Car and Truck Design. Automotive Industries, vol. 46, no. 23, June 8, 1922, pp. 1278-1279. New all-aluminum car. Rosenhain's aluminum alloy for pistons. Germans light alloys in high-speed engines. Aluminum forging and soldering.

RESEARCH IN NON-FERROUS METALS. Non-Ferrous Metal Research Affects Design of Small Automotive Parts. Automotive Industries, vol. 46, no. 23, June 8, 1922, pp 1289-1290. New coefficient of expansion determined for nickel; properties of monel metal; brazing flux.

AUTOMOBILES

DIFFERENTIALS, WITH AND WITHOUT. With and Without the Differential, G. E. Bradshaw. Autocar, vol. 48, no. 1382, April 15, 1922, pp. 611-613. Upholding argument that differentialless axle is not suitable for touring cars.

SUSPENSION. New System of Spring-Suspension for Automotive Vehicles, H. M. Crane. Soc. Automotive Engrs. Jl., vol. 10, no. 6, June 1922, pp. 463- 465, 2 figs. History; Hotchkiss drive for Shaft-driven cars, rear-axle mountings and device developed by author.

TRANSMISSION, MECHANICAL SHIFT. Gear Transmission with a Mechanical Shift, H. O. Herzog. Am. Mach., vol. 57, no. 1, July 6, 1922, p. 17, 5 figs. on p. 16. Describes Saden gear shift, a German device; 4 speeds and reverse; operator merely selects speed desired, shift is mechanical.

AVIATION

LANDING BY ELECTROMAGNETIC RADIATION. The Field Radiated from Two Horrizontal Coils, Gregory Breit. Sci. Papers of Bur. of Standards, no. 431, Mar. 10, 1922, pp. 589-606, 5 figs. Type of transmitting coil antenna devised and formulas for current received in coil aerial.

TRAFFIC LAW PROPOSED. Proposed Air Traffic Law, Geo. Ripert. Aerial Age, vol. 15. no. 14, June 12, 1922, pp. 320-323. Suggestions for international laws deduced from those adopted at international conventions and by various governments.

B

BABBITT

BABBITT. The Microstructure of Babbitt Metal, A. McArthur Johnston and R. W. Irwin. So. African Instn. of Engrs. Jl., vol. 20, no. 10, May 1922, pp. 197-211, 21 figs. Characteristics, construction, and properties of alloys recommended by Chamber of Mines Eng. Standardization Committee; nature of microstructure [illegible] physical properties likely to be found.

BEAMS

PLATE. Dimensions of Plate Beams (Dimensionierung Einfach Bewehrter Plattenbalken), Leo Baron. Bauingenieur, vol. 3, no. 9, May 15, 1922, pp. 273-275. Gives new, simplified, expeditious and reliable method of calculation, and [illegible]

[illegible] Shear Problem in Beams Concrete, vol. 20, no. 6, June 1922, pp. 243-244, 8 figs. Importance of their anchorage and new [illegible]

[illegible] METALS

[illegible] Red Brass Bearing Metals for [illegible] und Rotguss-Lagermetalle [illegible] Zeit. für die Gesamte Giesserei- [illegible] 316-317. Composition of bearing [illegible] percentages of tin, zinc, [illegible] physical properties, elasticity, [illegible]

BEARINGS

BABBITTED, TROUBLES. Fourteen Causes of Trouble With Babbitted Bearings, L. D. Allen. Belting, vol. 20, no. 6, June 1922, pp. 55-56, 1 fig. Points that should be investigated when bearings give trouble.

MOTOR. Some Pointers on Bearings, A. L. Gear. Elec. Rev. & Indus. Engr., vol. 80, no. 6, June 1922, pp. 265-270, 309-310, 13 figs. Sleeve-bearing materials, design and construction.

STEAM-ENGINE, LUBRICATION OF. The Problem of Lubricating Steam-Engine Bearings, W. F. Osborne. Power, vol. 56, no. 2, July 11, 1922, pp. 53-54, 1 fig. Method of lubrication; effect of characteristics of engine on selection of suitable lubrication.

BEARINGS, BALL

ADVANTAGES. On the Quality of Various Bearings and the Advantages of Ball Bearings (Note sur les qualités générales des divers paliers de transmissions, avantages des paliers à billes), H. Bursie. Revue Générale de l'Electricité, vol. 11, no. 21, May 27, 1922, pp. 792-794, 3 figs. Progress made in recent years in journal bearings and SKF ball bearings.

BELT DRIVE

POWER TRANSMISSION BY. Power Transmission by Belting. Machy. (Lond.), vol. 20, no. 507, June 15, 1922, pp. 325-327, 4 figs. Characteristics of leather belting and charts for simplifying calculations.

POWER TRANSMITTED. How much Power is Belt Transmitting? W. F. Schaphorst. Nat. Engr., vol. 26, no. 6, June 1922, pp. 268-269, 1 fig. Simple method of determining from easily obtained instruments.

BELTING

CELLULOSE. Experiments With Cellulose Belting (Versuche mit Zellstofftreibriemen), M. Rudeloff. Zeit. des Vereines deutscher Ingenieure, vol. 66, nos. 19 and 20, May 13 and 20, 1922, pp. 466-469 and 491-494, 23 figs. May.13: Equipment for experiment, details of testing operation and conditions under which each test was carried out. May 20: Discusses friction in ball bearings in pulley-driven machinery; determination of useful work; records of revolution counters.

GRAIN ELEVATORS. Belting Systems in Two Large Grain Elevators, D. R. Egbert. Belting, vol. 20, no. 6, June 1922, pp. 13-17, 6 figs. Reconstructed C. & N. W. elevator contains 8½ miles of conveyor and elevator belt; New Orleans public elevator; four installations compared.

SLIDE RULE, CALCULATION BY. The Improved Belt Slide Rule, Carl G. Barth. Management Eng., vol. 2, no. 6, June 1922, pp. 351-354, 2 figs. As now constructed it solves problems for three classes of belts, viz., machine, heavy countershaft and light countershaft.

BLAST FURNACES

CHINA. New Steel Plant is Wholly Chinese. Trans.-Pacific, vol. 6, no. 4, April 1922, pp. 72-74, 1 fig. Some details of 250-ton blast furnace of Lungyen Min. Administration near Peking which is expected to make iron this spring.

FUEL ECONOMY. The Alabama Company's No. 1 Stack Breaks Production Record on Low Fuel Consumption, H. R. Stuyvesant. Blast Furnace and Steel Plant, vol. 10, no. 6, June 1, 1922, pp. 343-346. 1 fig. Production increased 17 per cent, coke consumption decreased 30 per cent; labor force reduced 50 per cent.

BOILER, FEEDWATER

FEEDING COMPOUND WITH. Methods of Feeding Boiler Compound With the Feed Water, W. H. Wakeman. Southern Engr., vol. 37, no. 4, June 1922, pp. 43-45, 4 figs. Description of successful application.

BOILER PLATES

STRENGTH AND ELASTICITY. Strength and Elasticity of Boiler Plate at Elevated Temperatures, H. J. French. Chem. and Met. Engr., vol. 26, no. 26, June 28, 1922, pp. 1207-1209, 3 figs. Proportional limit maintained or increased with first temperature rise; tensile strength has slight maximum at about 250 deg. cent., but both fall off badly at higher temperatures; reduction and elongation have minimum at about 260 deg. cent., but recover their original value around 450 deg. cent.

BOILER TUBES

SAFE ENDS, ELECTRIC WELDING. Electrically Safe Ending Boiler Tubes, J. J. Sullivan. Boiler Maker, vol. 22, no. 6, June 1922, pp. 153-154, 2 figs. Summary of results in safe-ending boiler tubes and flues with Thomson electric butt welder at Nashville, Chattanooga & St. Louis Ry., Nashville, Tenn.

BOILERS

ELECTRICALLY HEATED. Production of Steam and Hot Water in the Electric Boiler (Dampf- und Warm-wassererzeugung in elektrischen Dampfkesseln), Hindelang. Zeit. des Bayer. Revisions-Vereins, vol. 26, no. 10, May 31, 1922, pp. 84-85, 1 fig. Providing hot water to Municipal Bath and German Museum in Munich.

FIRE BRIDGES. Refractories in Central Heating Boilers (Schomatte-Eimbauten in Zentralheizungs-Kesseln) de Grahl. Glasers Annalen, vol. 90, no. 12, June 15, 1922, pp. 215-221, 5 figs. Naseel fire bridge and tests made to establish its efficiency, including flue-gas analysis, determination of heat losses, etc.

LADD-BELLEVILLE. Large Units of Modern Boiler Plants (Les grandes unités des chaufferies modernes), C. Radiguer. Revue Générale de l'Électricité, vol. 11, no. 24, June 17, 1922, pp. 897-906, 6 figs. Describes Ladd-Belleville boilers at Ford plant on River Rouge, their operation, upkeep, firing with gas and pulverized coal, etc.

See also Locomotive Boilers.

BOILERS, WATER-TUBE

SPEARING, MANUFACTURE OF. The Manufacture of the Spearing Boiler. Eng. Rev., vol. 35, no. 11, May 1922, pp. 379-381, 3 figs. Facts about design, manufacture and testing of this comparatively new type.

BRASS

FORGINGS. Brass Forgings, C. G. Heiby. Metal Industry (N.Y.), vol. 20, no. 6, June 1922, pp. 220-221. How produced; chilled cast blanks; composition of metal; microstructure of forgings. Paper read at Convention of A. F. A.

The Development of Brass Forging, Oscar T. Roder. Forging and Heat Treating, vol. 8, no. 6, June 1922, pp. 256-259, 7 figs. Art of working brass while hot; general details of process of presses used and of die construction; composition; physical properties; microstructure of forgings and castings.

484

BRAZING

Dip Brazing and Heat Treatment. Dip-Brazing With No. 20 Brass and the Heat Treatment of Brazed Joints, E. V. [illegible] Chem. and Met. Eng., vol. 26, no. 24, June 14, 1922, pp. 1121-1125, 9 figs. Satisfactory methods for dip brazing; strengths of joint and effect of heat-treatment; [illegible] of brazed joints; strength of bond between brass and steel.

BRIDGES, CONCRETE

Arch, Wide Span. Arched Bridges of Wide Span, Dr. F. von Emperger. Eng. and Contracting, vol. 57, no. 22, May 31, 1922, pp. [illegible], 11 figs. Austrian engineer's demonstration of possibilities in stone and concrete beyond ordinarily accepted limits. Summary of paper read before Swedish Concrete Inst. in 1921.

Dover Street Viaduct. Dover Street Viaduct Scheme, L. C. Mouchel. Ferro-Concrete, vol. 13, no. 10, Apr. 1922, pp. [illegible], 16 figs. Description of construction including main viaduct 1000 ft. long, including two bridges, a spur and a separate bridge.

Elora, Ontario. High Level Concrete Bridge, Elora, Ont., A. W. Connor. Can. Engr., vol. 42, no. 21, May 23, 1922, pp. 517-521, 2 figs. Two span reinforced concrete arch structure 85 ft. high replaces steel truss structure; old trusses utilized as support for ribs during concreting; deck supported by ribs; old masonry utilized.

Springfield, Mass. Springfield-West Springfield Bridge. Pub. Works, vol. 52, nos. 20, 21, 23 and 24, May 20, 27, June 10 and 16, 1922, pp. 365-368, 384-386, 417-419, and 449-451, 17 figs. Structure 1,494 ft. across Connecticut River containing 54,000 cu. yds. concrete, 3,560 tons of steel and nearly 11,000 foundation piles. Various features of construction.

BRIDGE DESIGN

Waterways Calculation. Hydraulic Design of Bridge Waterways, Ivan E. Houk. Eng. News-Rec., vol. 88, no. 26, June 29, 1922, pp. 1071-1075. Each opening requires individual design; formulas are makeshifts; cloudburst data; applying 1913 flood and Pueblo flood figures; scour velocities; other considerations.

BRIDGES, HIGHWAY

Girder, Concrete Truss. Concrete Truss Girder in New Street Viaduct at Dover. Eng. and Contracting, vol. 57, no. 22, May 31, 1922, pp. 513-514, figs. 8-19. Details of design and severe test on new street viaduct at Dover.

Substructure, Edmundston-Madawaska. Substructure of Edmundston-Madawaska Bridge, C. McN. Steeves. Can. Engr., vol. 42, no. 22, May 30, 1922, pp. 545-549, 7 figs. International highway bridge of four 232-ft. spans replaces cable ferry over St. John river; piers on well-compacted sand and blue clay containing boulders; reinforcement at pier faces; Pontoon construction. Paper read before Eng. Inst. of Canada.

BRIDGES, LIFT

Substructure, Victoria. Substructure, Johnson St. Bridge, Victoria, B.C., F. W. Allwood. Can. Engr., vol. 42, no. 23, June 6, 1922, pp. 577-579, 6 figs. Central single-leaf spans with plate girder spans at either end; construction of concrete piers and abutments; details of caisson construction; launching and sinking caissons; pouring concrete under water.

BRIDGES, STEEL

Revelstoke, B.C. New Bridge Over the Columbia River at Revelstoke, B.C., Contract Rec., vol. 36, no. 24, June 14, 1922, p. 558. 1 fig. Tenders to be received soon for six-span steel structure with five concrete piers on piles and 2 deep-water piers of steel cylinder design.

BUILDING CONSTRUCTION

Column Removal in Skyscraper. Removal of Three First-Story Columns in Twenty-Seven Story Building, Edward F. Weiskopf. Eng. News-Rec., vol. 89, no. 1, July 6, 1922, pp. 4-7, 6 fig. Transfer of load accomplished by using cantilever trusses as levers; elastic distortion of columns taken up by jacking; procedure checked by straingage readings.

BUILDINGS

Concrete, Reinforced. The Tallest Reinforced Concrete Building in the United States, A. E. Wynn. Concrete and Constructional Eng., vol. 17, no. 6, June 1922, pp. 365-371, 7 figs. Eighteen-story all reinforced concrete office building represents most modern methods in engineering and most scientific use as structural and architectural building attainment.

BUSES

Trolley, Overhead Materials for. Overhead Materials and Current Collection Equipment for Trolley Bus Lines, M. W. Manz. Bus Transportation, vol. 1, no. 6, June 1922, pp. 327-330, 1 figs. Advantages of continuing use of present standards as far as practicable. Details of trolley harp, base and overhead special work design.

C

CABLES, ELECTRIC

Breakdown Strength. On the Minimum Stress Theory of Cable Breakdowns, Donald M. Simons. Am. Inst. Elec. Engrs. Jl., vol. 41, no. 6, June 1922, pp. 433-438. Discusses Fernie's theory that point of minimum stress, which occurs at sheath of a cable is its limit of strength; his experimental data.

Voltage, Rating In Relation to. Rating of Cables in Relation to Voltage. Am. Inst. Elec. Engrs. Jl., vol. 41, no. 6, June 1922, pp. 418-422. Summarized history of published knowledge bearing upon performance of insulation under electric stress. Prepared by Subcommittee on Wires and Cables of Standards, Committee.

CANS

Seaming, Special Machines for. Building Special Machines for Can-Seaming, Arthur Mumper. Machy. (N.Y.), vol. 28, no. 11, July 1922, pp. 899-902, 3 figs. Highly developed type of single-purpose machine which closes ends of cylindrical tin containers.

CAR CONSTRUCTION

Side Frame. A One Piece Wrought Steel Truck Side Frame. Ry. Rev., vol. 70, no. 24, June 17, 1922, pp. 918-920, 6 figs. Symington type which is sheared and formed under hydraulic press; electric welded in final form.

CAR LIGHTING

Generator, Direct-Drive. Direct Driving Axle Generators for Passenger Cars. Ry. Rev., vol. 70, no. 25, June 24, 1922, pp. 972-974, 5 figs. Am. Ry. Assn. committee on train lighting and equipment report direct drive still in development stage. (Abstract.)

Generator, Body Suspension. Long Island Changes Generator Suspensions. Ry. Elec. Engr., vol. 13, no. 6, June 1922, pp. 190-192, 2 figs. Truck mounted machines placed on car bodies show economy by giving greater belt mileage.

CARS, COAL

N. & W. Ry., 120-Ton. Coal Car of 120-Tons Capacity — Norfolk and Western Railway. Ry. and Locomotive Eng., vol. 35, no. 6, June 1922, pp. 142-145, 7 figs. Details of construction and design.

CASE-HARDENING

Distortion. Distortion Produced in Case-hardening, A. A. Blue. Am. Mach., vol. 56, no. 25, June 22, 1922, pp. 915-916, 3 figs. Consistent minimum warpage in manganese steel; large holes decrease, small holes increase when carbonized; greater wall thickness produces greater effect.

Steel, Failures. Causes of Failures in Case-Hardening Steel. Iron Age, vol. 109, no. 26, June 29, 1922, pp. 1807-1808. Non-metallic impurities, chiefly dissolved oxides, responsible in many cases in which hardening process has been thought at fault.

Selective. Selective Case-Carburizing, W. P. Wood and O. W. McMullan. Chem. & Met. Eng., vol. 26, no. 23, June 7, 1922, pp. 1077-1080, 4 figs. Review of various methods of producing local cases; in general, electrodeposited copper has furnished best protection; non-metallic coating whose application and removal presents no great difficulties is described.

CAST IRON

American vs. British. American Versus British Grey Cast Iron, F. J. Cook. Can. Foundryman, vol. 13, no. 6, June 1922, pp. 26-32, 7 figs. Superior qualities of British iron shown; sulphur and phosphorus not as detrimental as generally believed; soft castings depreciate value of American machinery.

CASTINGS

Centrifugal. Centrifugal Castings, N. Lilienberg. Blast Furnace & Steel Plant, vol. 10, no. 7, July 1922, pp. 375-379, 9 figs. States advantages of making centrifugal castings in vertical molds rather than in horizontal molds as is customary; theoretical calculations necessary for method are given.

Cutting and Welding. Cutting and Welding of Castings, G. O. Carter. Iron Trade Rev., vol. 71, no. 2, July 13, 1922, pp. 107-110. Minimum interruption caused by changing of tips, altering of pressures, etc.; castings should be segregated according to size of risers. Paper read before Am. Foundrymen's Convention.

Feeding Heads, Without. The Making of Castings Without Feeding Heads, E. Ronceray. Foundry Trade Jl., vol. 25, no. 302, June 1, 1922, pp. 393-397. Suggestions of importance in practice which would obviate necessity for heads in many cases. Paper read before Inst. British Foundrymen.

Plaster Molds for. Plaster Moulds for Small Castings. Machy. (Lond.), vol. 20, no. 509, June 29, 1922, pp. 398-399, 2 figs. Advantageous features for models and exacting commercial work.

CEMENT

Sulphide. Investigation of Sulphide Cement, H. F. Clemmer. Highway Engr. & Contractor, vol. 6, no. 6, June 1922, pp. 33-34, 2 figs. Work of Testing Bureau benefits manufacturer and ensures delivery of good materials.

CEMENT MANUFACTURE

Fusion Process. Possibilities of Fusion Process for Cement Production, S. L. Meyers. Concrete, vol. 20, no. 6, June 1922, pp. 105-107, 5 figs. This process contains fuel economy possibilities that rotary kiln with sintering methods does not.

CEMENT MILLS

Iowa. Building and Operating Iowa's First Cement Plant, W. T. Christine. Cement, Mill & Quarry, vol. 20, no. 10, May 20, 1922, pp. 25-34, 19 figs. Plant was put into operation in 1908; intricate process of cement manufacture; waste-heat boiler furnishes all power to operate plant.

CEMENT, PORTLAND

Chemical Analysis. Interpreting the Chemical Analysis of Portland Cement, J. C. Witt. Cement & Eng. News, vol. 34, no. 6, June 1922, pp. 21-23. Suggested system of recasting has not demonstrated relationship of results with physical behavior.

CENTRAL STATIONS

Superpower. The Superpower Undertaking in Styria (Austria) (Das steirische Grosskraftwerksunternehmen), Richard Hofbauer. Elektrotechnik u. Maschinenbau, vol. 40, no. 23, June 4, 1922, pp. 265-269. Discusses power works of Enns group, Mur groupe, water-storage works at Teigitsch and Mixnitz, and districts they supply with power.

CIRCUIT BREAKERS

Oil. Baltimore Oil Circuit Breaker Tests, H. C. Louis and A. F. Bang. Am. Inst. Elec. Engrs. Jl., vol. 41, no. 6, June 1922, pp. 399-405, 9 figs. Results of tests made by Consolidated Gas, Electric Light and Power Co. of Baltimore by throwing three-piece metallic short circuits directly on system which breaker was called upon to clear immediately.

Breakers Withstand Short-Circuit Tests. Elec. World, vol. 80, no. 1, July 1, 1922, pp. 21-23, 3 figs. With minor modifications, all types ruptured short circuits several times in succession without failure; oscillogram studies made in each case; ample capacity provided back of short circuits.

CITY PLANNING

New York and Vicinity. Planning for an Urban Population of Thirty-Seven Millions. Am. City, vol. 26, no. 6, June 1922, pp. 533-536, 1 fig. Sage Foundation announces regional planning study covering 300 communities in New York area.

COAL

Briquetting. Briquetting of Peat (Brikettierung von Rohtorf oder Kohlenschlamm durch maschinelle Druckentwässerung ohne Bindemittel), Kampers. Technische Blätter, vol. 12, no. 5, Feb. 4, 1922, pp. 49-51, 4 figs. Processes depending on extracting water by pressure.

LOW-GRADE FOR PLASTIC FUEL. Plastic Fuel Can Be Made of Low-Grade Coal and [illegible] Can Be Coked Even if Non-Coking Coal Is Used, George H. Dacy. Coal Age, vol. 21, no. 23, June 8, 1922, pp. 953-956, 5 figs. With fine grinding almost all but inherent ash is removed by Trent process; ash may be reduced to 1 per cent; amalgam produced twice as much gas as ingredients separately.

PRODUCTION COSTS. Analyzing the Cost of Producing Anthracite, S. D. Warriner. Min. & Metallurgy, no. 187, July 1922, pp. 7-9. Explanation of wide difference in price to consumer from labour cost in mine.

SMOKELESS, ILLINOIS. Illinois Coal as a Source of Smokeless Fuel, S. W. Parr. Power Plant Eng., vol. 26, no. 12, June 15, 1922, pp. 600-605, 13 figs. Why some coals are called non-coking; effects of oxygen; low-temperature coking.

STEAMING. Coal Steaming, A. W. Binns. Power Plant Eng., vol. 26, no. 12, June 15, 1922, pp. 595-598, 8 figs. Costs, steam consumption and mechanical details.

COAL HANDLING

EQUIPMENT FOR ASH AND. On Coal and Ash Handling Equipment, Harry R. Westcott. Power House, vol. 15, no. 10, May 20, 1922, pp. 25-29 and 42. Numerous types of apparatus for these purposes are described in outline, and suitability of one or other is indicated under differing conditions.

COILS

SELF-INDUCTANCE OF CIRCULAR. The Self-Inductance of Circular Coils, H. B. Dwight. Elec. Jl., vol. 19, no. 6, June 1922, pp. 268-270, 4 figs. Curves from which self-inductance can be read thereby avoiding long formulas; also useful in design of reactance coils, choke coils and air-cored balancing coils for transformers.

COKE

NON-COKING COALS. Coke from "Non-Coking" Coals. Iron & Coal Trades Rev., vol. 104, no. 2828, May 12, 1922, pp. 708-709. Process of heating non-coking coals so rapidly that resinous content is decomposed before excessive oxidation occurs.

COMPASSES

ADJUSTMENTS. Adjustments of the Compass, C. H. Peabody. Mar. Eng., vol. 27, no. 7, July 1922, pp. 439-442, 10 figs. Causes of deviation of compass and methods of compensation.

GYROSCOPIC, RECORDS. Gyro-Compass Records, R. E. Kortepeter, Sperryscope, vol. 3, no. 6, June 15, 1922, pp. 5-7, 5 figs. Description of 4-hour- and 30-day-course recorders, and advantages of each.

COMPRESSORS

See Air Compressors.

CONCRETE

ALKALI ACTION. The Effect of Alkali Upon Concrete, S. H. McCroy. Cement & Eng. News, vol. 34, no. 6, June 1922, pp. 17-18. Decomposition caused and explanations of it offered. No method known of preventing such deterioration, but impermeability retards it. Recommendations as to aggregate, proportioning and placing of concrete.

HYDRATED LIME IN. Plasticity is the Chief Purpose of Hydrated Lime in Concrete. Contract Rec., vol. 36, no. 25, June 21, 1922, pp. 583-585. Engineer's report states that chief merit of lime in concrete is production of smooth, workable mix; reduction in strength is unimportant.

LUMBER. Concrete Lumber Industry Is Growing, W. A. Scott. Concrete Products, vol. 22, no. 6, June 1922, pp. 29-31, 8 figs. Company in California has developed system of manufacture which is leased in assigned territory.

SAND CLASSIFICATION. Improving Concrete Sand by Classification, E. Shaw. Concrete Products, vol. 22, no. 6, June 1922, pp. 59-61, 3 figs. Reclassification of sand involves throwing out grains finer than 48 mesh; some experiences with sand reviewed.

SPECIFICATIONS. Grading and Measuring Concrete Aggregates, R. C. Yeoman. Cement, Mill & Quarry, vol. 20, no. 10, May 20, 1922, pp. 35-36. Indiana specifications for handling sand and gravel; 1–2–4 concrete requires 1½ bbls. of cement, 0.45 cu.yd. of sand and 0.89 cu.yd. of gravel.

CONCRETE CONSTRUCTION, REINFORCED

CALCULATION. Reinforced Concrete Construction Work and Calculations (Rechnung und Konstruktion im Eisenbetonbau), Robert Otzen. Bauingenieur vol. 3, no. 9, May 15, 1922, pp. 262-266, 1 fig. Methods of calculating cross-sections, stresses, etc., develops formulas and gives examples of application.

CONDENSERS, STEAM

AIR PUMPS FOR. The C. M. and M.-Delas Air Extractor. Electrician, vol. 88, no. 2300, June 16, 1922, pp. 718-719, 3 figs. Results of tests made in Paris workshops of Société Condenseurs Délas.

TUBE PACKING. Condenser Tube Packing. Am. Mar. Engr., vol. 17, no. 6, June 1922, pp. 25-31, 17 figs. Underlying causes of corrosion and an easy economical solution of problem.

COOLERS

LIVE-STEAM. Live-Steam Coolers (Heissdampf-Kühlapparate). Archiv für Wärmewirtschaft, vol. 3, no. 5, May 1922, pp. 91-92, 4 figs. Describes cooler built by Sieffert & Co., A. G., for cooling live steam to be used in manufacturing [illegible] supply [illegible] insufficient.

COPPER METALLURGY

ELECTROLYTIC REFINING. Electrolytic Refining of Copper, H. T. Burns, vol. 8, no. 6, June 1922, pp. 1-5, 2 figs. Description of process in which impurities and precious metals are removed from product of Anaconda casting furnaces.

CORROSION

[illegible] Influence of Molecular Concentration on Immersion-Test Investigations, D. M. Strickland. Chem. & Met. Eng., [illegible] rate of corrosion [illegible] approaches spent solutions often harmless, but sometimes accelerate corrosion; short tests in [illegible] tests.

COST ACCOUNTING

[illegible]

CRANES

ELECTRIC. Electric Cranes. Mech. World, vol. 71, no. 1846, May 19, 1922, pp. 361-362, 1 fig. Operating speed and methods of crane motions; characteristics of motors, both D.C. and A.C. rating and electric braking.

HAMMERHEAD, 200-TON. Two-Hundred-Ton Fitting Out Crane at Camden Yard. Mar.Eng., vol. 27, no. 6, June 1922, pp. 383-385, 4 figs. Details of construction and operation of huge electrically operated hammerhead crane installed at South Yard of N.Y. Shipbldg. Corp.

CUPOLAS

CHARGING MACHINES. Charging Machines for Cupolas. Engr., vol. 133, no. 3470, June 30, 1922, pp. 727-728, 5 figs. Design of Thwaites Bros., Ltd., Bradford, which combines comparative low first cost and ease of installation.

CUTTING METALS

CUTTING FLUIDS FOR. Cutting Fluids, Eugene C. Bingham. Am. Mach., vol. 56, no. 26, June 29, 1922, pp. 958-961, 4 figs. Why adhesion is important lubrication factor; relative physical properties found by tests; best oil for each operation and material. (Abstract.) Tech. Paper No. 204, Bur. of Standards.

D

DAMS

CONCRETE. Construction of Loch Ravan Dam, Wm. A. Megraw. Pub. Works, vol. 62, nos. 24 and 25, June 17 and 24, 1922, pp. 437-439 and 460-462, 5 figs. Solid concrete structure 640 ft. long overall, spillway 288 ft. long, rising 103 ft. above bed rock. Raising dam 52 ft., using concrete chuted to place from one end. Gravity and machinery used in plant with considerable cost exceeds million dollars. Paper read before Am. Water Wks. Assn.

PINE HILL. Pine Hill Dam. Public Works, vol. 52, no. 22, June 3, 1922, pp. 397-399, 3 figs. Foundations 62 ft. deep built in 10 sections with iron stop plates in construction joints. Water cushion formed by weir. Part of main dam built in narrow long sections temporarily serving as cofferdams.

DIESEL ENGINES

AIR SUPPLY. Air for Diesel Engine-Installations, W. P. Sillince. Oil Eng. & Finance, vol. 1, nos. 11 and 13, Mar. 25 and Apr. 8, 1922, pp. 370-371 and 439-440. Survey of air for combustion of fuel, for starting and maneuvering engines, for injection of fuel and to operate auxiliaries.

CONSTRUCTION AND OPERATION. Diesel and Semi-Diesel Engines (Moteurs Diesel et Semi-Diesel), Ed. Allar. Bul. des Associations Françaises de Propriétaires d'Appareils à Vapeur, vol. 3, no. 8, Apr. 1922, pp. 86-105, 5 figs. Theory, principle of combustion, construction, operation, and application.

PETROLEUM AS FUEL. Some Characteristics of Petroleum Oils Used on Diesel Engines, Harold Moore. Oil Eng. & Finance, vol. 1, no. 14, Apr. 15, 1922, pp. 458-460 and 463-464. Number of analyses of fuel oils from various sources and their value as means of predicting behavior of new oils of similar characteristics. Paper read before Diesel Engine Users Assn.

TOSI. Internal-Combustion Engines (Les moteurs à combustion interne). Génie Civil, vol. 80, no. 25, June 24, 1922, pp. 561-564, 7 figs. Compares two-stroke and four-stroke Diesel engines, their application for marine purposes, and describes in detail Tosi Diesel four-stroke engine.

DISTILLATION

LOW-TEMPERATURE. Low-Temperature Distillation (Essais de Distillation à basse température), M. Laffargue and R. Jaugey. Annales des Mines, vol. 1, no. 5, May 1922, pp. 327-347, 1 fig. Utilization of lignite; process of low-temperature distillation; experimental results.

DRAINAGE

PUMPING PLANT. Drainage System Supplemented by High Capacity Pumping Plant, W. A. Scott. Eng. World, vol. 20, no. 6, June 1922, pp. 341-345, 17 figs. Methods of bank protection and current control on Sacramento, Cal.

DURALUMIN

GEARING, FOR. Duralumin for Gearing, Robert W. Daniels. Am. Mach., vol. 57, no. 2, July 13, 1922, pp. 62-65. History of duralumin; some properties that make it desirable for worm and other gearing; its strength and wearing qualities.

DUST

PRECIPITATION, ELECTRICAL. Electrical Precipitation of Dust and Its Application in the Purification of Gas (La précipitation électrique des poussières), Saget. Bul. de la Société Française des Électriciens, vol. 2, no. 12, Feb. 1922, pp. 83-100, 6 figs. Discusses precipitation in metallurgical, sulphuric acid, and other plants, and advises its more general adoption.

DYNAMOMETERS

TRACTOR, RECORDING TYPE. The Watson Dynamometer, George W. Watson. Engineering, vol. 113, no. 2948, June 30, 1922, pp. 814-816, 10 figs. Tractive force transmitted by oil pressure in one cylinder to spring-actuated piston in smaller cylinder. Link motion controls stylus recording on paper roll actuated by speed of tractor. Time and furrow depth also recorded.

E

EARTH

FULLERS, PREPARATION AND USE. Commercial Preparation and Use of Fullers Earth, T. P. Maynard and L. E. Mallory. Chem. & Met. Eng., vol. 26, no. 23, June 7, 1922, pp. 1074-1076. A highly siliceous clay, usually indurated, which has property of absorbing certain organic coloring matters from vegetable and mineral oils. Occurrence, origin, physical character; bleaching power.

ECONOMIZERS

VALUE OF. The Case for the Economizer, Julius Frith. Engineer, vol. 133, no. 3468, June 16, 1922, pp. 655-656, 3 figs. Rapid application of first principle usually shows coal economy but not always reduction of operating costs and features which influence this result.

EDUCATION, ENGINEERING

Technical Literature, Use of. Instruction of Students in the Use of Technical Literature; an Unexploited Phase of Engineering Education, J. H. McClelland. Eng. & Contracting, vol. 57, no. 25, June 21, 1922, pp. [illegible]. Importance of research in present-day manufacture and available literature from which to start.

ELECTRICAL MACHINERY

Temperature Limits. Temperature Limits in Large Machines, Philip Torchio. Am. Inst. Elec. Engrs. Jl., vol. 41, no. 6, June 1922, pp. [illegible]-451, 8 figs. Discussion of safe temperatures which make for efficiency; effect on life of fibrous insulation and new tentative conventional allowance for reducing to maximum copper temperature.

ELASTICITY

Moduli. The Modulus of Elasticity in Mechanical Construction Work (Le rôle du module d'élasticité dans la construction mécanique), R. de Fleury. Revue de Métallurgie, vol. 19, no. 5, May 1922, pp. 298-302. Its application to malleable iron, aluminum bronzes and other light metals, and construction of Diesel, aeronautical, and automobile engines.

ELECTRIC DISTRIBUTION

Secondary Construction. Secondary Construction of Proved Value, L. C. Peterman. Elec. World, vol. 79, no. 23, June 10, 1922, pp. 1167-1170, 3 figs. Description of method of supporting secondary circuits of the Chillicothe (Ohio) Elec. Ry Light & Power Co., having given satisfactory service for four years.

ELECTRIC FURNACES

Design. New Electric Furnaces for Temperatures of 2500 Degrees and Over (Neuartige elektrische Ofen für Temperaturen von 2500° und darüber), E. Löwenstein. Centralblatt für Mineralogie, Geologie und Paläontologie, no. 9, May 1, 1922, pp. 283-285, 3 figs. Describes furnace built by Göttinger Elektroschaltwerk, in which high temperatures can be reached quickly, temperatures can be accurately regulated, current consumption is small; suitable for metals and minerals, and difficulty fusible earths of all kinds.

Development. Developing an Electric Furnace, R. Sylvany. Iron Trade Rev., vol. 71, no. 1, July 6, 1922, pp. 33-34. Experience in application of electrometallurgy shows certain definite conditions must be met in designing efficient melting unit; factors involved are discussed; new French furnace is described briefly.

Electrodes, Continuous. Soderberg Self-Baking Continuous Electrodes, C. W. Soderberg and M. Sem. Chem. & Met. Eng., vol. 26, no. 25, June 21, 1922, pp. 1178-1182, 7 figs. Outline of process of manufacture of continuous electrodes at furnace; installations in various types of furnaces; ferro-alloy; carbide; steel; electric pig iron. Advantages over ordinary carbon electrodes. Cost comparisons. Probable trend of future developments.

Fiat. Development of the Italian Iron Industry by Extensive Use of Electric Power in Smelting Works (Ueber die Entwicklung der italienischen Eisenindustrie durch weitgehende Anwendung elektrischer Energie im Schmelzbetrieb), Dornhecker. Stahl u. Eisen, vol. 42, no. 22, June 1, 1922, pp. 845-848, 3 figs. Discusses electric furnaces in iron foundries, especially Fiat furnace, and works of Fiat Co.

Single-Phase. Single-Phase Electric Furnaces, H. P. Abel, A. A. Liardet and W. West. Foundry Trade Jl., vol. 25, no. 302, June 1, 1922, pp. 398-401. Description and advantages of this type of furnace. Suggestions for overcoming objections due to unbalancing of load on generators of usual two, three or polyphase type.

ELECTRIC GENERATORS, A.C.

45,000-kva., Canada. Description of the 45,000-kva. Queenston Generators, B. L. Barns and F. Bowness. Am. Inst. Elec. Engrs. Jl., vol. 41, no. 6, June 1922, pp. 459-463, 6 figs. Detailed description of vertical shaft type generator with direct-connected exciter.

ELECTRIC LAMPS, INCANDESCENT

Dangers. Danger of Touching Unclean Incandescent Bulbs (Gefährdungsmöglichkeiten bei Berührung unsauberer Glühlampen), Stefan Jellinek. Elektrotechnische Zeit., vol. 43, no. 24, June 15, 1922, pp. 815-817, 4 figs. Discusses case of a death resulting from touching glass bulb covered with spots of lime; in investigations very considerable potentials were found by making contact with unclean bulbs.

ELECTRIC LOCOMOTIVES

British Design. Electric Locomotives, Vincent L. Raven. Ry. Gaz., vol. 36, no. 25, June 23, 1922, pp. 994-996, 2 figs. Design of shunting, freight and passenger locomotives. Foreign practice in relation to British conditions. Summary of paper read before Instn. Mech. Engr.

ELECTRIC METERS

Phase-Angle. A New Phase-Angle Meter, L. F. Vieillard. Ry. Signal Engr., vol. 15, no. 6, June 1922, pp. 224-225, 2 figs. Device facilitates adjustment of A.C. track circuit, increasing efficiency of operation.

ELECTRIC MOTORS

Selection and Application. Fundamentals in Selection and Application of Electric Motors, Gordon Fox. Power, vol. 55, no. 26, June 27, 1922, pp. 1007-1009. General machine requirements and loads; motor characteristics to meet them; classification of motor types.

ELECTRIC MOTORS, D.C.

Reversing Switches. Reversing Switches as Used in Electric Motor Controllers. Power, vol. 55, no. 25, June 20, 1922, pp. 967-969, 20 figs. Reversing direction of direct current motors and different types of switches used.

ELECTRIC PLANTS

Turbo-Alternator. Some Notes on the Design of Generating Plant, C. F. Hewitt. Elec. Times, vol. 61, no. 1599, June 8, 1922, pp. 552-553. Reliability; working conditions; thermal economy, capital cost, ease of operation and general accessibility are design factors in order of their importance.

ELECTRIC RAILWAYS

Single-Phase Car Equipment. New Single-phase Equipment for the New Haven, Walter H. Smith. Ry. Age, vol. 72, no. 24, June 17, 1922, pp. 1477-1479, 5 figs. Two master controllers installed in trail cars permit operation from any car in train.

Single-Phase Interurban. Operation of Single-phase Interurban, C. N. Wilcoxon. Elec. Traction, vol. 18, no. 6, June 1922, pp. 489-492, 4 figs. Some details of service and operation on Chicago Lake Shore and South Bend Ry. after 14 years.

ELECTRIC TRANSMISSION LINES

220,000-Volt. 220,000-Volt Transmission and Apparatus, J. F. Peters. Eng. Inst. of Canada Jl., vol. 5, no. 6, June 1922, pp. 296-301, 8 figs. Field of application of 220-kv. transmission; description of equipment, and reference to two 220-kv. systems under construction in California.

ELECTRIC WELDING

Apparatus. Electric Welding Installations (Elektrische Schweissanlagen), Karl Midsch. 'Metall-Technik, vol. 48, no. 19. May 4, 1922, pp. 205-208, 10 figs. Discusses electric arc, resistance, and spot welding, and explains operations and apparatus.

Development. The History of the Development of Electric Welding, J. M. F. Wilson. Elec. News, vol. 31, nos. 7 and 11, Apr. 1 and June 1, 1922, pp. 35-37 and 40-41, 3 figs. Discusses carbon-electrode and metal-electrode systems of welding; selection of electrodes; impurities, etc.

ELECTROCHEMICAL INDUSTRY

Advances. Recent Advances in Applied Electrochemistry, Maurice de Kay Thompson. Jl. of Franklin Inst., vol. 193, no. 6, June 1922, pp. 775-794, 9 figs. General survey of progress made in this field.

ENAMELS

Coating. Microscopic Study of Ground Coat and Cover Coat Enamel Reactions, E. E. Geisinger. Am. Ceramic Soc. Jl., vol. 5, no. 6, June 1922, pp. 322-337, 13 figs. Study showing that susceptibility of enamels to furnace gases is easily classified by cross-section under microscope; examples.

ENERGY

World, Economics of. A Swedish Scientist onthe World Energy Economics, Svante Arrhenius. Eng. Progress, vol. 3, no. 6, June 1922, pp. 136-138. Consideration of sources of energy which are still available and how long they are likely to last.

ENGINEHOUSES

Equipment. Expediting Enginehouse Work at Hoboken. Ry. Mech. Engr., vol. 96, no. 6, June 1922, pp. 301-304, 8 figs. Modern machine equipment and efficient labor-saving devices show good results at D. L. & W. enginehouse.

EXPLOSIVES

C. P. Toluene. Report on the Manufacture of C. P. Toluene from By-Products Plants and Petroleum Distillates, W. K. Kirby. Alumini Mag. of Colorado School of Mines, vol. 12, no. 2, June 1922, pp. 5-10. Description of toluene and its production by scrubbing coal or water gas and synthetic process by cracking petroleum distillates.

Detonators, Lead Plate Test. The Lead Plate Test as Applied to Commercial Detonators, Bennett Grotta. Chem. & Met. Eng., vol. 26, no. 24, June 14, 1922, pp. 1126-1132, 12 figs. Tests and experiments demonstrating its value in grading commercial detonators according to well-defined standards; efficiency of commercial detonators.

Liquid Air. Use of Liquid Air as an Explosive(Empleo de oxigeno liquido como explosivo), Eduardo Carvajal. Revista Minera, Metalurgica y de Ingenieria, vol. 73, no. 2829, Apr. 24, 1922, pp. 230-233, 3 figs. Making of cartridges; comparative costs; method of operation.

F

FANS

Forced-Draft, Operating Characteristics. Operating Characteristics of Forced-Draft Fans, H. E. Corl. Power, vol. 55, no. 26, June 27, 1922, pp. 1012-1013, 2 figs. Recent developments due to underfeed stokers; new type of fan in which maximum hp. is only approximately 5 per cent higher than rated hp.

Output and Efficiency. The Characteristic Curves of Fans, and Their Application to Pre-determine the Output and Efficiency of Fans Working Singly and In Parallel on Various Resistances, Joseph Parker. Instn. Min. Engrs. Trans., vol. 63, part 3, May 1922, pp. 222-234, 11 figs. Brief consideration of a comprehensive view of all laws brought into operation by two fans working in parallel. See also Min. Instn. of Scotland Trans., vol. 43, Apr. 22, 1922, pp. 22-34, 11 figs.

FERTILIZERS.

Industry. The Fertilizer Business as a Chemical Industry, F. S. Lodge. Am. Fertilizer, vol. 56, no. 12, June 17, 1922, pp. 28-37, 3 figs. Some features of largest group of heavy chemical industries.

The Fertilizer Industry in the United States, J. G. Lipman. Soc. Chem. Industry Jl., vol. 41. no. 11, June 15, 1922, pp. 233-237. Fertilizing material; manufacture of artificial fertilizer and its future. Paper read before Chem. Industry Club.

FIRE PREVENTION

Building Materials Tests. Lessons of Fire Tests, S. H. Ingberg. Clay Worker, vol. 77, no. 7, June 1922, pp. 657-660, 5 figs. partly on p. 661. Brick as fire-resisting material and some results of tests on steel and concrete columns subjected to fire conditions. Paper read before Nat. Brick Mfrs. Assn. convention.

Reinforced-Concrete Slab Tests. British Fire Tests on Reinforced Concrete Slabs. Indian Eng., vol. 71, no. 20, May 20, 1922, pp. 278-279, 5 figs. on supp. plate. Dept. of Sci. and Indus. Research four-hour tests, maximum temperature 2,000 deg. fahr., followed by 5 min. water application.

FLOATING DOCKS

Reinforced-Concrete. Reinforced Concrete Floating Dock of 2,000 Tons at Trieste (Dock flottant en béton armé, de 2,000 tonnes, du port de Triste). Génie Civil, vol. 80, no. 22, June 3, 1922, pp. 489-491, 8 figs. Details of construction and equipment.

FLOORS

CONCRETE. Hardening Concrete Floors, Edward D. Boyer. Cement & Eng. News, vol 34, no. 6, June 1922, p. 28. Sometimes defects in workmanship make use of remedies advisable.

FLOW OF WATER

PIPE-CAPACITY CHART. Chart That Solves Pipe-Capacity Problems, W. F. Schaphorst. Coal Age, vol. 21, no. 24, June 15, 1922, pp. 999-1000, 1 fig. Chart from which velocity that water will travel through a pipe of given diameter may be quickly determined in cu. ft. gals. or lb. per min.

FOUNDATIONS

REINFORCED-CONCRETE IN COMPRESSED AIR WORK. Reinforced-Concrete as a Building Material in Compressed Air Foundation Work (Eisenbeton als Baustoff bei Druckluftgründungen), Joachim Schultze. Beton u. Eisen, vol. 21, no. 8, May 9, 1922, pp. 113-116, 4 figs. Compares properties of reinforced-concrete and wood and discusses advantages of each.

FOUNDRY EQUIPMENT

COMPRESSED AIR. Compressed Air Applied to the Foundry, R. Hoadley Tingley. Compressed Air Mag., vol. 27, no. 6, June 1922, pp. 153-158, 20 figs. Description of some of many air appliances indispensable in modern foundry practice.

FUELS

COAL AND OILS. Relative Value of Coal and Oils as Fuels, C. H. Butz. Forging & Heat Treating, vol. 8, no. 6, June 1922, pp. 262-265, 6 figs. Comparison made by means of charts based upon practical operating figures obtained from processes varying in nature from very inefficient furnace to highly efficient boiler.

UTILIZATION ON RAILWAYS. Utilization of Fuels on Railroads—6th Report of the Commission for the Utilization of Fuels (L'Utilisation des combustibles sur les chemins de fer—Sixième rapport de la Commission d'utilisation des combustibles). Génie Civil, vol 80, no. 20, May 20, 1922, pp. 449-453. Effect of electrification of railway lines; character and performance of steam locomotives; production and use of steam; etc.

See also Automobile Fuels, Coal, Coke, Gasoline, Oil Fuel, Pulverized Coal.

FURNACES, BOILER

CARE AND UPKEEP. Views of Mechanical Engineers in Wyoming Valley as to Proper Care and Upkeep of Boiler Furnaces, D. C. Ashmead. Coal Age, vol. 21, no. 26, June 29, 1922, pp. 1083-1087, 3 figs. Anthracite boiler practice inefficient; some plants install Dutch ovens; combustion arches increase temperature and steadiness of heat; large-size fuel may ruin arches; water softening much needed; fireclay as a mortar.

FURNACES, HEATING

FUEL ECONOMY. Fuel Economy in Heating Furnaces, K. Huessener. Blast Furnace & Steel Plant, vol. 10, no. 7, July 1922, pp. 380-383, 2 figs. New methods to obtain increased production with decreased fuel consumption from regenerative and recuperative furnaces.

G

GAGES

GAGE BLOCKS. Interference Methods for Standardizing and Testing Precision Gage Blocks, C. G. Peters and H. S. Boyd. Scientific Papers Bur. of Standards, no. 436, May 2, 1922, pp. 677-713, 21 figs. Use of interference of light waves makes possible detection of errors within a few millionths of an inch.

WEAR, ALLOWING FOR. Allowing for Gage Wear, R. Dumas and E. C. Peck. Am. Mach., vol. 56, no. 26, June 29, 1922, pp. 953-954. Discussion of desirability of having fixed tolerance or an allowance for wear; difference of American and British points of view.

GALVANIZING

HEAT TRANSMISSION IN. Heat Transmission in the Hot-Galvanizing Process, J. D. Keller. Blast Furnace and Steel Plant, vol. 10, no. 7, July 1922, pp. 371-373, 2 figs. Describing thermal features of process; rate of motion of sheets through bath should vary with sheet thickness if based on factor of heat transmission.

GARAGES

RAMP AND ELEVATOR TYPE. Comparison of Ramp and Elevator Type Garages, Harold F. Blanchard. Bus Transportation, vol. 1, no. 6, June 1922, pp. 331-335, 12 figs. Description of comparative capacities and convenience.

GAS CLEANING

FILTERING PROCESS. A New Process For Scrubbing Gases and Vapours, E. Stach. Eng. Progress, vol. 3, no. 6, June 1922, pp. 127-130, 7 figs. Rotary filtering process by Freytag-Messler for removing dust, tar, oil, and other impurities more completely than hitherto.

LIQUIDS, BY. Report on Liquid Purification, A. M. Beebe. Gas Age-Rec., vol. 49, no. 24, June 17, 1922, pp. 741-743, 2 figs. Investigations into Seaboard and O' Neill systems by Committee of Empire State Gas and Elec. Assn., and their results.

GAS MANUFACTURE

BY-PRODUCT FOR INDUSTRIAL USES. By-Product Gas Industrial Uses, Harry Dobrin. [illegible] pp. 719-722. Present day utilization of this type of gas, formerly thought unfit for most purposes. Paper read before joint session of Birmingham Sec. of A.S.M.E. and Am. Iron and Steel [illegible]

GAS PRODUCERS

SEABOARD BY-PRODUCT COKE PLANT. Producer Gas for By-Product Ovens, Freeman D. Lohr. Gas Age.-Rec., vol. 49, no. 22, June 3, 1922, pp. 677-681, 8 figs. Description of new plant built to meet increasing demand for gas and decreasing market for coke.

GASOLINE

[illegible] Heavier Oils, E. W. Dean and W. A. Jacobs. Petroleum World, vol. 19, no. 261, June 1922, pp. 225-226 [illegible] 1 fig. [illegible] illation and vapor-phase processes; exper[illegible] n same. See also Petroleum Times, vol. 7, [illegible] and 915.

HIGH-EXPLOSIVE, PROCESS FOR. New Process Makes High-Explosive Gasoline. Oil Trade Jl., vol. 13, no. 6, June 1922, p. 15. Wm. J. Knox perfects invention which will increase percentage of distillate recovered from crude on large scale.

GEAR-CUTTING MACHINES

GEOMETRIC CONTROL. Geometric Control of Gear Cutter Movement, Chester B. Hamilton, Jr. Can. Machy., vol. 27, no. 22, June 1, 1922, pp. 40-41 and 48, 4 figs. Careful grinding of cutters is necessary to maintain proper shape; using mill type of cutter; machines for cutting double-helical gears are of special design.

SPUR, MUIR AUTOMATIC MACHINE. The Muir Automatic Spur Gear Generating Machine. Machy. (Lond.), vol. 20, no. 506, June 8, 1922, pp. 292-294, 4 figs. Teeth of spur gears are formed with rackshape cutter which has vertical reciprocating motion across face of gear blank.

FELLOWS HIGH-SPEED SHAPER. New Fellows High-Speed Gear Shaper. Machy. (Lond.), vol. 20, no. 507, June 15, 1922, pp. 329-332, 6 figs. Machine that operates with a shaping action and generates gear teeth from gear-shape cutter.

SPUR, HOBBING. Cutting Spur Gears by Hobbing. Machy. (Lond.), vol. 20, no. 509, June 29, 1922, pp. 393-398, 5 figs. Setting up gear-hobbing machines; examples from practice; application of multiple-threaded hobs; cutting small pinions.

GEARS

AUTOPITCH. A New Form of Gear. Eng. Production, vol. 4, no. 88, June 8, 1922, pp. 545-548, 24 figs. Development of new type of gear as an attempt to reach requirements of theoretically ideal one; description of extent to which attempt is successful. Abridgment of paper read before Instn. of Engrs. and Shipbuilders.

HELICAL AND SPUR. Helical Gears and Spur Gears, W. G. Dunkley. Machy. (Lond.) vol. 20, nos. 500 and 506. Apr. 27 and June 8, 1922, pp. 105-107 and 300-302, 9 figs. April 27: Effect of sliding action on uniform velocity and on relative efficiency. June 8: Contact conditions of spur gears; load distribution and periodical variations; effect of variation of load distribution on uniformity of rotation; effect of increased speed.

GLASS

COMPOSITION AND DURABILITY. An Examination and Extension of Zulkowski's Theory of the Relation between the Composition and Durability of Glasses, Wm. L. Baillie. Soc. of Glass Technology Jl., vol. 6, no. 21, May 1922, pp. 68-95 and (discussion) 95-101, 1 fig.

DURABILITY. A Critical Examination of Methods Commonly Used in Determining the Durability of Glass, W. E. S Turner. Soc. Glass Technology Jl., vol. 6, no. 21, May 1922, pp. 30-45. Four methods of testing.

GOLD METALLURGY

ONTARIO. Development of Metallurgical Practice at the Hollinger Mine, P. A. Robbins. Eng. and Min. Jl.-Press, vol. 113, no. 25, June 24, 1922, pp. 1093-1097, 1 fig. Early history of enterprise; original mill; amalgamation vs. cyanidation; treatment of high-grade ore; development of present practice.

H

HANDLING MATERIALS

SAFETY IN. Making Material Handling Safe. Vernon C. King. Iron Trade Rev., vol. 71, no. 1, July 6, 1922, pp. 29-32, 8 figs. Greatest number of industrial accidents occur in handling of material; use of proper trucking and conveying equipment is aid to safety; discipline and morale are essential factors. Paper presented before Worcester Sec. A.S.M.E.

See also Coal Handling.

HARBORS

CHINA. The Harbor Facilities of Chefu, China (Beschouwingen in verband met den havenaanleg te Chefoo (China), O. C. A. Van Lidth de Jeude. Ingenieur, vol. 37, no. 25, June 24, 1922, pp. 476-485, 15 figs. Detailed description of harbor works, construction of quays, dams, revetements, etc.

DETERIORATION OF CONSTRUCTION MATERIAL. The Deterioration of Materials Used in Harbor Construction. Engineering, vol. 113, no. 2946, June 16, 1922, pp. 739-740. Information gathered by Committee appointed by Inst. Civil Engrs on means of protecting timbers from destructive marine parasites, and concrete construction that will stand up under salt water conditions.

HARDNESS

TESTING. The Ball Hardness Test, Dr. Moore. Metal Industry (Lond.), vol. 20, no. 22, June 2, 1922, pp. 510-513, 1 fig. Indentation tests being purely empirical should specify conditions. Features of Brinell test and Meyer's laws. Paper presented before Inst. of Metals.

HEAT TRANSMISSION

MEASUREMENT. American Heat Transmission Measurement by the Two-Plate System (Amerikanische Wärmedurchgangsmessungen nach der Zweiplatten methode) Max Jakob. Zeit. für die gesamte Kärte-Industrie, vol. 29, no. 5, May 1922, pp. 83-87, 3 figs. Recent works carried out by Bur. of Standards and Am. Soc. Heat and Vent. Engrs.

HEATING AND VENTILATING

CLEVELAND PUBLIC AUDITORIUM. Ventilating Equipment of Cleveland's Public Auditorium, M. A. Boyd. Heat. and Vent. Mag., vol. 19, no. 6, June 1922, pp. 33-40, 9 figs. Methods followed in handling air supply for largest plastered structure in world.

HEATING, STEAM

GENERAL FIRE EXTINGUISHER CO. Heating System of the General Fire Extinguisher Co., Chas. L. Hubbard. Power Plant Eng., vol. 26, no. 12, June 15, 1922, pp. 591-595, 10 figs. Steam is generated at high pressure and used only for heating. Power is purchased from an outside source.

BUILDING HEATING PLANT. World's Largest Gas Heating Plant, S. S. Fyfe. Gas Age-Rec., vol. 49, no. 25, June 24, 1922, pp. 765-768, 3 figs. Gas-fired steam boilers at Los Angeles; heats building of 3,000,000 cu. ft. using mixed natural and artificial gas.

HIGHWAYS

Construction Materials. Controlling Quality of Materials in Highway Construction, John H. Bateman, Can. Engr., vol. 42, no. 25, June 20, 1922, pp. 631-634 Field and laboratory tests: methods of obtaining samples; testing materials for concrete; control of cement concrete; standardizing tests. Paper read before Eighth Annual Conference in Highway Eng.

HOISTING ENGINES

Steam and Air Combination. Combination Steam and Air Hoist, R. C. Demary. Nat. Engr., vol. 26, no. 6, June 1922, pp. 244-246, 5 figs. Description of twin tandem compound with Corliss-type valve gear; high-pressure cylinders which are used for compressing air.

HOISTS

Skip. Elevating Coke by Skip Hoist. Gas Age-Rec., vol. 49, no. 22, June 3, 1922, pp. 683-684 and 687, 5 figs. Taking coke from small cars to elevated bins by means of automatic device; straight-up lift eliminates consideration of belt conveyor.

HYDRAULIC TURBINES

Queenston-Chippawa 55,000-Hp. Queenston-Chippawa 55,000-Horsepower Hydraulic Turbines, Frank H. Rogers. Power, vol. 56, no. 2, July 11, 1922, pp. 40-44, 12 figs. Five units being installed to operate under 305-ft. effective head; each weighs 2,000,000 lb., 620,000 lb. of which is in turbine; new type of turbine casing and operating gear developed. (Abstract.) Paper read before Hydro-electric conference under auspices of Phila. Engrs. Club.

HYDROELECTRIC DEVELOPMENTS

Tunnel for Kern River Plant. Hydro-Electric Development Involves Unusual Tunnel Job, H. K. Fox. Eng. News-Rec., vol. 89, no. 2, July 13, 1922, pp. 50-55, 8 fig. Reconstruction of Kern River plant requires enlargement of 8,300 ft. of rock tunnel; location, topography, and ground give rise to special problems.

HYDROELECTRIC PLANTS

France. Hydroelectric Plant of Baumont-Monteaux (Usine hydro-électrique de Beaumont-Monteux), J. Reyval. Revue Générale de l'Electricité, vol. 11, no. 21, May 27, 1922, pp. 781-790, 17 figs. A central station situated at confluence of Isère and Rhone; will supply current to industrial works; general description of parts of plant and engineering work connected with it.

New Brunswick. New Hydro Plant in New Brunswick. Elec. News, vol. 31, no. 11, June 1, 1922., pp. 34-39, 9 figs. Unique installation just completed at Musquash River, near St. John; actually two plants in one; work of New Brunswick Power Commission.

Queenston-Chippawa, Canada. Arrangement for Handling 500,000-Kw. Load from Queenston Plant. Elec. World, vol. 79, no. 25, June 24, 1922, pp. 1261-1263, 2 figs. Most economical utilization of water power available and protection against interruption of service were chief factors influencing design of this new station of Hydro-Electric Power Commission of Ontario.

Queenston-Chippawa Hydro Development Largest in the World. Power, vol. 55, no. 26, June 27, 1922, pp. 1000-1006, 9 figs. Initial installation five 55,000-hp. hydroelectric units; 305 ft. of 327-ft. head between Lake Erie and Lake Ontario effective on turbines; water carried through concrete-lined canal designed for possible ultimate capacity of 600,000-hp.

Semi-Outdoor. Semi-Outdoor Hydro-Electric Plant with Backwater Suppressor, John A. Sirnit. Elec. World, vol. 79, no. 23, June 10. 1922, pp. 1161-1164, 5 figs. Mitchell Dam development of the Alabama Power Company will involve an entirely new principle in hydroelectric construction. Results of long series of experiments in backwater suppression.

Switzerland. Hydroelectric Plant of Fully (Valais' Switzerland). Using a Head of 1,650 m. (Usine hydro-électrique de Fully (Vailis, Suisse), utilisant une chute de 1,650 mètres), Ch. Dantin. Génie Civil, vol. 80, nos. 18 and 19, May 6 and 13, 1922, pp. 393-397 and 423-427, 29 figs. partly on supp. plate. May 6: Describes civil-engineering features, damming of Fully Lake, pressure piping, etc. May 13: Electric generating machinery; turbine regulators; pipe lines.

I

INDICATORS

Indicator Diagrams of Compound Engine. Indicators Diagrams of Compound Engines. Power, vol. 56, no. 2, July 11, 1922, pp. 55-58, 10 figs. Classification of engine types; fixed and variable low-pressure cut-off. Other characteristics which determine proper setting of valves.

Micro, for High-Speed Engines. The Collins Micro-Indicator for High-Speed Engines. Engineering, vol. 113, no. 2945, June 9, 1922, p. 716, 3 figs. Description of instruments which within half a minute will produce on card ten successive indicator diagrams of performance of a high-speed engine.

INDUSTRIAL MANAGEMENT

Business Depression Cycle. Facts May Prevent Depressions, Ernest F. Dubrul. Iron Trade Rev., vol. 70, no. 25, June 22, 1922, pp. 1791-1794. Ignorance of business cycles brings reversals; burden rests upon management of modern industry to study basic factors; should contribute to general store by frank publicity about its own conditions.

Cost Explanation for Employees. Interpreting the Corporation to the Workers, C. M. Ripley. Elec. World, vol. 79, no. 25, June 24, 1922, pp. 1281-1282, 2 figs. Value of explaining distribution of costs to employees.

Manager's Problems. Solving the Manager's Present Day Problems, John H. Van Deventer. Indus. Management, vol. 64, no. 1, July 1922, pp. 1-3. Barriers to improved methods and how to overcome them.

Planning and Controlling, Chart for. Planning and Controlling Work in the Assembling Department of a French Shop, E. Jullien. Am. Mach., vol. 56, no. 25, June 22, 1922, pp. 932-933, 6 figs. Work plotted on revolving calendar and always under control of planning department; forms used for assembly specifications and piece-work tickets.

Purchase Controlled by Output Records. Making Output Records Control Material Purchases, Kenneth Coggeshall. Indus. Management, vol. 64, no. 1, July 1922, pp. 6-11, 23, 6 figs. Practical procedure for conservative purchasing with materials in stock bought at former high levels.

INSULATION

Paper, Dielectric Strength. Effects of the Composite Structure of Impregnated Paper Insulation On Its Electric Properties, Wm. A. Del Mar and C. F. Hanson. Am. Inst. Elec. Engrs. Jl., vol. 41, no. 6, June 1922, pp. 439-445, 10 figs. Quantitative expression of power-factor and dielectric loss in terms of resistivities and specific capacities of elements of insulation.

INTERNAL-COMBUSTION ENGINES

Fuels. Research Aimed at Solution of Fuel Problem, Herbert Chase. Automotive Industries, vol. 46, no. 26, June 29, 1922, pp. 1412-1418, 5 figs. Co-operation of automotive and petroleum industries; new knock preventive announced by General Motors; lubricating problems also discussed.

The Value of Gas Engine Fuels, Letson Balliett. Min. Rev., vol. 24, no. 5, June 15, 1922, pp. 14-15. Exposition of impossible claims to increase heat values of hydrocarbon fuels; use of fuel oil in blacksmith's shop.

Combustion. Combustion Research—An Aid to Better Performance, Herbert Chase. Automotive Industries, vol. 46, no. 23, June 8, 1922, pp. 1253-1265, 2 figs. Internal-combustion engines; factors affecting detonation; flame propagation and related subjects examined by various investigators.

Sproule. The Sproule Internal Combustion Engine. Oil Eng. and Finance, vol. 1, no. 81, March 4, 1922, pp. 277-279, 1 fig. Description of engine in which it is claimed that difficulties of limited flexibility, low efficiency, and lack of easy reversibility are almost completely overcome.

See also Airplane Engines, Automobile Engines, Diesel Engines, Gas Engines, Oil Engines.

IRON

Metallography. Influence of Graphite on Iron, J. W. Bolton. Foundry, vol.. 50, no. 11, June 1, 1922, pp. 436-443, 19 figs. Theories advanced for varying effects of graphite on cast iron and semi-steel explain states in which it is found; causes are analyzed; micrographs illustrate points.

Oxidizing Gases, Effect of. Effect of Oxidizing Gases at Low Pressure on Heated Iron, H. C. H. Carpenter and C. F. Elam. Blast Furnace and Steel Plant, vol. 10, no. 6, June 1, 1922, pp. 317-319, 7 figs. Principal agent in production of characteristic facets of oxide is mixture of gases evolved by copper on heating.

IRON INDUSTRY

Nord-Paris Co. Plant. The Works of the Nord-Paris Company. Engineering, vol. 113, no. 2945, June 9, 1922, pp. 708-709, 2 figs. Description of steel works, iron foundry, large machine shop, and auxiliary buildings covering some 50,000 sq. yd.

IRON ORE

Chromite. Chromite for the Manufactuie of Ferro-Chrome, J. A. Holden. So. African Min. and Eng. Jl., vol. 33, no. 1595, Apr. 22, 1922, pp. 1120-1121, 1 fig. Rhodesian and new Caledonian ores contrasted; varieties suitable for electro-metallurgical smelting and some features of process.

Electric-Furnace Reduction. Electrothermic Reduction of Iron Ores and Pyrites (Sulla riduzione elettrotermica dei minerali di ferro e delle ceneri di pirite), Stefano Pagliani. Forno Elettrico, vol. 3, no. 12, Dec. 15, 1921, pp. 168-183, 13 figs. Development of direct reduction of iron ore in electric furnace; summary description of the various furnaces and their working.

IRON, PIG

Silicon, Lower. Foundries Can Use Lower Silicon Irons, Y. A. Dyer. Iron Age, vol. 109, no. 25, June 22, 1922, pp. 1749-1750. Blast furnacemen would be relieved by lessened demand for high silicon pig; call for high phosphorus iron may be overcome also.

IRRIGATION

Efficiency of. The Efficiency of Irrigation, G. E. P. Smith. Eng. and Contracting, vol. 62, no. 24, June 14, 1922, pp. 576-578. Ratio of water beneficially used to total water diverted onto land and conditions determining these factors.

K

KILNS

Continuous-Tunnel. Data on the Operation of a Continuous Tunnel Kiln at the Plant of the A. C. Spark Plug Company, S. J. McDowell and P. D. Helser. Am. Ceramic Soc. Jl., vol. 5, no. 6, June 1922, pp. 267-275, 3 figs. Description of simple construction permitting rapid heating and cooling; output depends upon ability to safely absorb heat necessary for their vitrification; used for firing spark plug porcelain insulators; total length, 75 ft., interior width, 2 ft. 8 in.

Operation. Correct Methods Lower Burning Cost J. H. Kruson. Brick and Clay Rec., vol. 60, no. 12, June 12, 1922, pp. 921-924, 4 figs. What happens in kiln during burning; gives outline for efficient burning records and suggests method fot studying burning process.

L

LAMPS, INCANDESCENT

Siemens Works, England. The Siemens Electric Lamp Works. Electricity, vol. 36, nos. 1646 and 1647, May 26 and June 2, 1922, pp. 268-270 and 274-276, 9 figs. Description of one of the best plants in England, at Dalston.

LEAD

Analysis, Rapid. Rapid Analysis of Impure Lead. Metal Industry (Lond.), vol. 20, no. 20, May 19, 1922, pp. 461-462. Description of simple process for analysis of lead and other materials in combination.

LEATHER

Drying Artificially. Artificial Drying of Leather. M. Hirsch. Eng. Progress, vol. 3, no. 6, June 1922, pp. 123-125, 5 figs. Arrangement for regulating admission of air according to progress of drying and proportioning recirculated and fresh air as drying proceeds.

LIGHTING

Industrial. Industrial Lighting: Ideal Requirements Legislative and Otherwise) and Practical Solutions, L. Gaster. Illuminating Engr., vol. 15, no. 2, Mar. 1922, pp. 74-88, 8 figs. Consideration of four essentials for ideal lighting and discussion of code. Paper read before Illuminating Eng. Soc.

Electric Signs. Better Signs, C. A. Atherton. Illuminating Eng. Soc. Trans. vol. 17, no. 5, May 1922, pp. 211-232, and (discussion) 232-234, 17 figs. Serious consideration from engineering standpoint. Equation by which spot sizes of light can be determined for various conditions and modifications giving maximum distance at which certain letters can be read.

LIGNITE

Carbonization and Distillation. Disintegration and Carbonization of Lignite (Verschwelung und Vergasung von Braunkohle), Conrad Arnemann. Braunkohle, vol. 21, no. 6, May 13, 1922, pp. 124-138, 4 figs. Symposium on modern distillating and carbonizing plants before German Lignite Industries Assn.

LIME

Plants. The New Rockland Lime Plant, Nathan C. Rockwood. Rock Products, vol. 25, no. 12, June 17, 1922, pp. 35-44, 36 figs. Six continuous discharge, gas-fired mount design kilns of which five turn out 130 tons of lime in 24 hours.

A Plant Ahead of Its Time, Clinton S. Darling. Rock Products, vol. 25, no. 12, June 17, 1922, pp. 59-68 32 figs. Rotary kiln for dry or semi-wet burning with 175 ft. flame; remarkable flexibility to make every lime product at Am. Lime and Stone Co.'s plant.

LIMESTONE

Iceland Spar, from. Pure Calcium Carbonate or "Iceland Spar", Oliver Bowles. Rock Products, vol. 25, no. 11, June 3, 1922, pp. 25-27. Limestone in its most valuable form is to be found in Iceland spar, occurrences of which are found in California, Montana, Spain and Argentina; property and uses.

LOCOMOTIVE BOILERS

Circulation, Effect on Efficiency. Effect of Circulation on Locomotive Boiler Efficiency, F. G. Lister. Ry. Rev., vol. 70, no. 22, June 3, 1922, pp. 787-790. Needed improvements in design for effecting better circulation, covered in paper presented at annual convention of Int. Ry. Fuel Assn. 1922.

Design and Maintenance. Current Problems in Boiler Design and Maintenance. Ry. Rev., vol. 70, no. 25, June 24, 1922, pp. 87-991, 9 figs. Am. Ry. Assn. Committee recommends standard practice for buttonhead stays and dry pipe sizes; advocates water treatment and hot-water washout systems. (Abstract).

LOCOMOTIVES

Fire Box, Water-Tube. Development of a Practical Water Tube Locomotive Fire box, D. L. Kiss. Ry. Rev., vol. 70, no. 24, June 17, 1922, pp. 900-908, 16 figs. Hungarian state railways successfully operating locomotives equipped with Broton type boilers; use of water purifiers an important factor.

Design and Equipment. Current Question of Locomotives Design and Equipment. Ry. Rev., vol. 70, no. 25, June 24, 1922, pp. 982-987, 1 fig. Am. Ry. Assn. Committee on locomotive construction considers relative merits of locomotive types and details in design. (Abstract.)

Fuel Economy. Effect of Tonnage Rating and Speed on Fuel Consumption, J. E. Davenport. Ry. Rev., vol. 70, no. 22, June 3, 1922, pp. 777-782, 10 figs. Practical interpretation of results of laboratory tests conducted in Pennsylvania Locomotive testing plant, showing heavy slow-speed trains to be most economical. Paper read before Int. Ry. Fuel Assn.

Locomotive Fuel—The Life Blood of Transportation, G. M. Basford. Ry. Rev., vol. 70, no. 22, June 3, 1922, pp. 782-785, 2 figs. Salient points in address at annual convention of Int. Ry. Fuel Assn.

Superheater. The Superheater Locomotive — Its Lubrication. Lubrication, vol. 8, no. 5, May 1922, pp. 49-60, 10 figs. Important features in operation and lubrication in connection with these.

LUBRICATING OILS

Frictional Loss, Testing. A Practical Way to Test Lubricating Oils for Frictional Losses, W. F. Osburne Power, vol. 55, no. 26, June 27, 1922, pp. 1010-1011. Readings to be taken; heat carried away from bearings; considerations other than bearing temperatures.

Storing and Handling. The Storage and Handling of Lubricating Oil, Allen F. Brewer. Indus. Management, vol. 64, no 1, July 1922, pp. 27-30, 4 figs. Application of engineering principles to elimination of waste and obtaining maximum efficiency.

Voltol. The Production of Voltol. Eng. Progress, vol. 3, no. 6, June 1922, pp. 121-122, 2 figs. Process of making high-viscosity oil from thin cheap ones under effect of electrical glow discharges in rarefied gas.

LUBRICATION

Lubricants and. Lubrication and Lubricants, W. A. Ludwick. Steam, vol. 29, no. 6, June 1922 pp. 157-164 Consideration of straight-run mineral, blended mineral, compounded and animal oils; greases; selection of lubricants.

Petroleum. Petroleum and Lubrication, E. A. Evans. Oil Eng. and Finance, vol. 1, no. 13, Apr. 8, 1922, pp. 434-436. Consideration of true friction and proper specifications for oil to overcome same; constitution of film; carbonization; emul- [illegible] Mar. [illegible]

M

[illegible]

[illegible] W. F. [illegible] Rock Products, [illegible] Washington [illegible] proper quality [illegible]

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[illegible]

MALLEABLE IRON

Manufacture. Malleable Anneals Not Packed. E. K Smith. Foundry, vol. 50, no. 11, June 1, 1922, pp. 457-458, 2 figs. Pot with flange at both ends is developed to prevent gases from entering and attacking castings; temperature must be kept low to eliminate warping when castings are not supported.

Sandardization. Standardizing Malleable Iron (Ueber die "Normung" von Temperguss), Rudolf Stotz. Giesserei-Zeitung, vol. 19, nos. 20 and 21, May 16 and 23, 1922, pp. 301-303 and 319-322, 3 figs. May 16: Dependence of tensile strength on thickness of wall and methods of production; gives figures for tensile strength from various foundries. May 24: Chemical composition and physical tests; shrinkage; etc.

METALLOGRAPHY

Preparation of Metal. Preparation of Metal for Microscopic Examination, Wm. Campbell. Chem. and Met. Eng., vol. 26, no. 25, June 21, 1922, pp. 1163-1164. Preparation of specimens, development of structures for various samples.

METALS

Fatigue. Fatigue of Metals, C. E. Stromeyer. Iron and Coal Trades Rev., vol. 104, no. 2831, June 2, 1922, pp. 282-824, 2 figs. Empirical law by which fatigue limit may be obtained by direct measurement quickly and fatigue coefficient within one-half hour. (Abstract.) Paper read before So. Wales Inst. of Engrs.

Calorizing. Calorization (Note sur la calorisation), Léon Guillet. Bul. Technique du Bureau Veritas, vol. 4, no. 4, Apr. 1922, pp. 83-86, 3 figs. Discusses methods of protecting metallic articles, especially calorization or coating by means of aluminum by Schoop spraying process.

Casting. The Casting of Metals, Thomas Turner, Brass World, vol. 18, no. 6, June 1922, pp. 191-195. Consideration of smelting and molding of metals as a whole with special attention to non-ferrous alloys. Lecture before Inst. of Metals.

Properties, Effect of Temperature on. The Effect of Temperature on Some of the Properties of Metals, F. C. Lea. Engineering, vol. 113, no. 2948, June 30, 1922, pp. 829-832, 11 figs. Results of experiments on critical points; tensile tests at from 40 deg. to 1000 deg. cent. tests on Armco iron; table showing properties of iron and certain steels at various temperatures; alloys of aluminum and copper. Paper read at Paris meeting of I.M.E.

METRIC SYSTEM

Arguments Against Adoption. Standardization and the Metric System (La standdardizzazione e la serie metrica standard), Narciso Desirello. Industria, vol. 36, no. 9, May 15, 1922, pp. 163-167, 6 figs. Concludes that metric system, although perfect theoretically is entirely inadequate for practical use and modern industrial exigencies.

MICA

Industry. Mica, Oliver Bowles. Bur. of Mines, Report of Investigation, no 2357, May 1922, 46 pp. 3 figs. Report of extensive investigation on mica industry and recent developments in foreign mica mining.

MINE LOCOMOTIVES

Germany. Mine Locomotive Conveying in the Ruhr District (Der Stand der Biubenlokomotiv-dörderung im Ruhrbezirk), O. Gunderloch. Glükauf, vol. 58, 58, nos. 20, 21 and 22, May 20, 27 and June 3, 1922, pp. 589-592, 616-622 and 653-657, 25 figs. Describes various types of benzol wired electric, accumulator; and compressed-air locomotives; their management and cost of operation.

MINERALS

Concentration by Alternate Currents. The Concentration of Minerals by Means of Alternate Electric Currents, W. M. Mordey. Min. Mag., vol. 26, no. 6, June 1922, pp. 333-343, 14 figs. Difference in action of alternate currents, electro-magnet and direct current types and means of using former; separation of minerals; practical application of tests. Paper read before So. Africa Instn. Elec. Engrs.

MINES

Concrete, Uses in. The Uses of Concrete in Mines, Anton S. Rosing. Can. Min. Jl., vol. 43, no. 21, May 26, 1922, pp. 321-323, 3 figs. Desirability due to resistance to fire and water.

Explosions. Explosions and Their Causes, Alexander McEachern. Can. Min. Jl., vol. 43, no. 25, June 23, 1922, pp. 395-397. Precautionery or preventative measures to be observed; researches abroad; safe practice. Paper read before Min. Sec. of U. S.

MINING

Methods. Mining Methods, C. F. Jackson. Min. and Metallurgy, no. 187, July 1922, pp. 27-28. Work of Mining Methods Committee to present general classification of methods and its relationship to physical characteristics of deposit; unit production data; publication of established experiences; revised mining method chart.

MOTOR TRUCKS

Parts Inspection. Rigid Inspection One of Rules at This Plant. Can. Machy., vol. 27, no. 25, June 22, 1922, pp. 47-48, 2 figs. Practice at Nat. Steel Car Corp., Hamilton, Ont. Parts purchased from outside sources are tested before leaving place of manufacture; further test given at Hamilton factory; jigs and fixtures are extensively used.

N

NITRATES

Supply. The Supply of Nitrate, A. W. Allen. Eng. and Min. Jl.-Press, vol. 114, no. 1, July 1, 1922, pp. 15-16, 2 figs. Mr. Ford's proposal calls attention to vital importance of adequate supply of mineral in peace as well as in war; Chilean deposits are far from exhaustion; synthetic production a problem of economics.

NICKEL ALLOYS

Chromel. Chromel Castings, Bars, Wire and Ribbons, E. F. Lake. Brass World, vol. 18, nos. 5 and 6, May and June 1922, pp. 158-161 and 165-167, 9 figs. Nickel-chromium alloy with higher chromium content than is found in others; its uses.

Nickel-Chromium Casting. Cast Nickel-Chromium Alloys, F. L. Lake. Foundry vol. 50, no. 11, June 1, 1922, pp. 452-454, 6 figs. Metals are melted in induction, arc and crucible-type electric furnace, purity found to be essential, iron added to one of alloys, occluded gases a menace in melting.

O

OIL ENGINES

Cold-Starting Crude. The Brotherhood Cold-Starting Crude Oil Engine. Engineering, vol. 113, no. 2946, June 16, 1922, pp. 746-748, 12 figs. Horizontal 4 cycle type started by compressed air on regular fuel. Will operate after starting on any grease that can be pumped.

OIL FIELDS

Ontario. Future Prospects for Oil and Gas Production in Ontario, M. Y. Williams. Can. Min. Inst. Trans. vol. 23, 1920, pp. 341-349 and discussion 347-350. Five geological formations which have produced petroleum in commercial quantities prospects on Manitoulin Island; James Bay slope; oil shales.

Western Canada. The Oil Possibilities of Western Canada, D. B. Dowling. Can. Min. Inst. Trans. vol. 23, 1920, pp. 351-359 and (discussion) 360-361, 2 figs. Location of oil-saturated sands in lower part of Cretaceous in 7 different localities; possibilities near Alberta.

OIL FUEL

Burning Efficiency. How to Burn Fuel Oil Efficiently, Jos. W. Hays. Refrigeration, vol. 30, no. 2, Apr. 1922, pp. 31-36. Correct conditions of furnace, atomizing burner, air supply and operation.

OIL INDUSTRY

Low-Pressure. Gas Utilization. Low-Pressure Gas for Oilfield Boilers. Oil Eng. and Finance, vol. 1, nos. 12 and 13, Apr. 1 and 8, 1922, pp. 412 and 431-432. Investigation of practicability of using low-pressure gas ordinarily wasted into the air and best types of gas burners.

OIL SHALES

Esthonian. The Chemical Properties of Esthonian Shales. Petroleum Times, vol. 7, no. 178, June 3, 1922, pp. 777-778. Some facts about most successful developments in this field and unusually rich properties of shale.

Kukkersite, the Oil Shale of Esthonia, E. H. Cunningham. Petroleum World, vol. 19, no. 261, June 1922, pp. 255-259. Facts about occurrence and development of one of richest oil shales known.

OPEN-HEARTH FURNACES

British Practice. British Open-Hearth Furnace Practice. Iron Age, vol. 110, no. 2, July 13, 1922, pp. 75-78, 2 figs. Higher temperatures and more rapid working aimed at in proposed design of a 100-ton furnace; reduction of heat losses great desideratum.

Design Improving. Improving Open-Hearth Design, Willis McKee. Iron Trade Rev., vol. 70, no. 26, June 29, 1922, pp. 1865-1868, 5 figs. Blow-torch principle insures better combustion; proposal to introduce gas into uptakes without regeneration; improved design is resulting in greatly increased output; better steel and longer life of furnace.

Valves. Gas and Air Valves for Open Hearth Furnaces, Wm. C. Bulmer. Blast Furnace and Steel Plant, vol. 10, no. 6, June 1,1922, pp. 302-306, 4 figs. Discussion of development of various types of valves for which inventor claims some superiority.

ORES

Present Value and Ore Reserves. Present Value in Its Relation to Ore Reserves, Plant Capacity, and Grade of Ore, Edwin S. Berry. Min. and Metallurgy, no. 187, July 1922, pp. 11-16. Losses in mining; sorting; purchase of adjacent property.

ORE DRESSING

Electro-Magnetic. Electro-Magnetic Dressing of Ore. Eng. Progress, vol. 3, no. 6, June 1922, pp. 117-121, 12 figs. Principles of magnetic separation historical development; methods of wet electro-magnetic separation.

OVENS

Electric, Enameling. Electric Ovens Are A Good Investment, West S. Scott. Elec. Rev. and Indus. Engr., vol. 80, no. 6, June 1922, pp. 275-277, 4 figs. Flexibility and ease of heat control, freedom from gases and low maintenance are among advantages of various examples discussed.

OXY-ACETYLENE CUTTING

Cutting Machines. Oxy-Acetylene Cutting Machine, I. William Chubb. Am. Mach., vol. 56, no. 25, June 22, 1922, pp. 929-931, 5 figs. Mechanically guided torch cuts intricate shapes at great speed; gas pressure and rate of torch travel regulated to suit work.

Machine, Efficiency of. Efficiency of Machine Cutting, Fred J. Maeurer. Acetylene Jl., vol. 23, no. 12, June 1912, pp. 587-595, 25 figs. Cutting with oxy-acetylene torch can be made to approach very closely maximum theoretical efficiency. Paper read before Am. Welding Soc.

Underwater. The Underwater Torch Makes Good. Pacific Mar. Rev., vol. 19, no. 6, June 1922, pp. 337-339, 5 figs. Temperature of 6,000 deg. fahr. enables diver to cut metals at any depth to which he can descend.

OXY-ACETYLENE WELDING

Foundries. Oxy-Acetylene Cutting and Welding in Foundry, G. O. Carter. Can. Foundryman, vol. 13, no. 6, June 1922, pp. 36-39. Piped oxygen and acetylene installations are recommended for large foundries. Many uses, such as cutting steel risers and welding gray iron.

P

PAINTS

Exposure Tests. Miscellaneous Exposure Tests, Henry A. Gardner. Educational Bur., Paint Manufacturers' Assn. of U. S. no. 153 June 1922, pp. 282-315, 12 figs. Durability tests on paints applied by spray gun vs. hand brush; three-years exposure results on Atlantic City panels; and tests on metal power paint, titanium oxide pigment and antimony oxide pigment.

PAPER MANUFACTURE

New Paper From Old. Making New Paper From Old Paper Stock, Sidney D. Wells. Paper, vol. 30, no. 14, June 7, 1922, pp. 7-10. Deinking processes for old newspapers and use of bentonite as peptizing agent.

PAPER MILLS

Machines, High-Speed. Developments in High Speed Machines. Paper, vol. 30, no. 12, May 24, 1922, pp. 7-11. Effect of late developments in making paper by high-speed processes.

PAINTS

White Pigments. New White Pigments, C. A. Klein. Chem. Industry, vol. 41, no. 10, May 31, 1922, pp. 209-210. Possibilities of two recently added pigments.

PAVEMENTS

Granite-Block. Recommended Procedure in the Construction of Granite Block Pavements, C. D. Pollock. Mun. and County Eng., vol. 62, no. 6. June 1922, pp. 207-210, 3 figs. Advantages of this type of pavement; laying and finishing it.

Wheel Load Distribution. Distribution of Wheel Load on Pavement Sections, H. F. Clemmer and C. A. Hogenthaler. Highway Engr. and Contractor, vol. 6, no. 6, June 1922, pp. 45-49, 4 figs. Tests on Bates experimental road in Illinois indicate effect of traffic.

PAVEMENTS, ASPHALT

Sand, for. Selecting and Proportioning Sand Asphalt Paving Mixtures, Prevost Hubbard. Rock Products, vol. 25, no. 11, June 3, 1922, pp. 37-39, 7 figs. Grading of sand to meet required specifications as told to 1922 convention of Am. Road Builders Assn.

PAVEMENTS, BRICK

Construction, Developments. Developments in the Methods of Constructing Brick Pavements. Contract Rec., vol. 36, no. 24, June 14, 1922, pp. 561-563. Importance of making construction durable and waterproof; asphalt cement fillers; even spacing; advantages of lug-brick.

PHASE MODIFIERS

Phase Advancers. Phase Advancers, Electricity, vol. 36, no. 1648, June 9, 1922, pp. 289-290, 2 figs. Description of A.C. exciter supplying magnetizing current to rotor 90 deg. ahead of working rotor current. This tends to improve power factor which has been lowered by induction motors. Describes Knapp vibrator type.

PHOSPHORIC ACID

Uses and Manufacture. Phosphoric Acid; its Uses and Manufacture, L. Carpenter, Chem. Age (Lond.), vol. 6, no. 158, June 24, 1922, pp. 830-831. As substituted for tartaric and citric acids in manufacture of jellys, preserves, and soft drinks. Combined with calcium and sodium as substituted for cream of tartar in baking and in making double superphosphate for fertilizer.

PILES

Protection by Gunite. Protection of Piles by Gunite. Can. Engr., vol. 42, no. 22, May 30, 1922, p. 549, 1 fig. Encasement of 2 in. of reinforced concrete resists Marine organisms; piles withstand driving and rough handling without damage.

PILES, CONCRETE

Types and Advantages. The Concrete Pile, Geo. P. Morrill. Concrete, vol. 20, no. 6, June 1922, p. 229-233, 6 figs. General discussion of advantages and methods of use.

PIPE, CAST-IRON

Centrifugal Process. Cast Iron Water Pipe Made by de Lavaud Process. Can. Foundryman, vol. 13, no. 5, May 1922, pp. 26-27, 33, 2 figs. Melted metal poured into revolving mold is deposited by centrifugal force against wall of mold; makes dense grained homogeneous casting.

Failure, Causes of. Causes of Failure in Cast Iron Pipe, F. A. McInnes. Eng. and Contracting, vol. 62, no. 124, June 14, 1922, pp. 563-564. Quality of pipe line; permissable sulphur content; importance of analyses of iron.

PIPE LINES

Cast Iron vs. Steel. Cast Iron or Steel Underground Pipes? (Les canalisations souterraines, fonte ou acier?), O. Hock. Revue Universelle des Mines, vol. 13, no. 4, May 15, 1922, pp. 245-264, 13 figs. Buried pipe lines for water, gas, and other purposes; seamless tubes, their flexibility, perosity, etc., joints; corrosion.

PIPES

Coating for Cast Iron and Steel. The Right Kind of Coating for Pipe, Wm. R. Conard. Fire and Water Eng., vol. 71, no. 25, June 21, 1922, pp. 1107-1108 and 1122, 1 fig. Suggestions for durable and efficient coating that will insure longer life for cast-iron or steel-pipe. From paper read before Convention of Am. Water Wks. Assn.

Tar Coating for. Present Day Tars for Pipe Coatings, Wm. R. Conard. Can. Engr. vol. 42, no. 22, may 30, 1922, pp. 560-561. Dr. Angus Smith's solution; standard-specification for pipe coatings; quality of tar used at present time; objective for research work. Paper read at Annual Mtg. Am. Water Wks. Assn.

PISTONS

[illegible] Aluminum Pistons (A Propos des Pistons en aluminium), Frank Jardine and Ferdinand Jehle. Technique Automobile et Aérienne, vol. 13, no. 117, 1922 pp. 54-59, 9 figs. Design and operation; measuring for temperature, tolerance, etc.

FOUNDATIONS. Second-Story Planer Foundations, A. E. Robinson. Am. Mach., vol. 56, no. 25, June 22, 1922, pp. 917-919, 4 figs. How American Tool Works supports its planer department upstairs; concrete slabs for foundations; methods of leveling and straightening long planer beds.

PLATES

RECTANGULAR, STRESS IN. Method for Approximate Static Calculation of the Bending Stress of Rectangular Plates (Verfahren zur angenähertenstatischen Berechnung biegefester rechteckiger Platten), Ludwig Hotopp. Beton u. Eisen, vol. 21, nos. 6, and 8, Apr. 5 and May 9, 1922, pp. 95-97 and 116-119, 8 figs. Discusses distribution of stresses and gives examples and calculations.

POLES, WOODEN

PRESERVATIVE TREATMENT. Penetration of Creosote, J. D. Burnes. Telephone Engr., vol. 26, no. 6, June 1922, pp. 35-36, 2 figs. Am. Wood Preservers Assn. committee tests effect of inner bark on creosote penetration of perforated and non-perforated cedar poles.

Roving Creosoting Plant, W. F. Norris. Telephone Engr., vol. 26, no. 6, June 1922, pp. 17-19, 44, 8 figs. Plant on wheels that brings treatment to poles; successful operation of compact outfit in storage yards.

POTASH

KELP, EXPERIMENTAL PLANT. The Work of the Experimental Kelp-Potash Plant of the Bureau of Soils, J. W. Turrentine. Chem. Age, (N.Y.), vol. 30, no. 5, May 1922, pp. 224-225, 5 figs. Development of products from kelp made possible by experiments of the Dept. of Agriculture at Summesland, Cal.

POWER FACTOR

SLIDE RULE. A New Power-Factor Slide Rule, P. L. Alger and H. W. Samson. Genl. Elec. Rev. vol. 25, no. 7, July 1922, pp. 455-457, 5 figs. New slide rule which solves power factor problems by means of solution of right triangles.

POWER PLANTS

CHILE. The Power Works of Chuquicamata (Los talleres y fuerza motriz de Chuquicamata). Ingenieria Internacional, vol. 8, no. 2, Aug. 1922, pp. 89-94, 3 figs. Production of power for mines and metallurgical works; a central heating station which burns oil and uses salt water

MANAGEMENT. Power Station Management. J. S. Thomson. Iron & Coal Trades Rev., vol. 104, no. 832, June 9, 1922, pp. 847-848. Sixteen economic areas suggested for England; most of power must come from thermal efficiency; gas and electric typical stations; automatic operations; steam considerations; electrical details.

PAPER MILLS. The Provincial Paper Mills Power Plant, T. H. Fenner. Power House, vol. 15, no. 11, June 5, 1922, pp. 19-23, 8 figs. Interesting features of boiler room and facilities for enlargement of plant.

PRESSES

POWER, CRANKSHAFT DESIGN. Designing Power Press Crankshafts, Wm. J. Smith. Eng. Production, vol. 4, no. 87, June 1, 1922, pp. 509-513, 5 figs. Details of calculations and formulas involved.

PULVERIZED COAL

BOILER FIRING. Progress in Pulverized Fuel Firing. F. J. Crolius. Blast Furnace and Steel Plant, vol. 10, no. 6, June 1, 1922, pp. 337-339. Code recommended for adoption by Carnegie Steel Company in handling of pulverized coal, presented; many points of unnecessary danger have been eliminated.

Powdered Fuel under Steam Boilers. Iron and Coal Trades Rev., vol. 104, no. 2, 832, June 9, 1922, p. 858. Summary of results of five boiler tests with pulverized Illinois coal, made by Milwaukee Elec. Ry. and Light Co.

FIRE HAZARDS. Fire Hazards in Plants Using Pulverized Coal, L. D. Tracy. Blast Furnace and Steel Plant, vol. 10, no. 7, July 1922, pp. 395-399. Various cases where fires and explosions originated from improper handling of pulverized coal; many hazards connected to apparatus used for pulverizing.

STATIONARY BOILERS. Use and Abuse of Powdered Fuel for Stationary Boilers, John E. Muhlfield. Blast Furnace and Steel Plant, vol. 10, no. 6, June 1922, pp. 353-355. Any great advance in combined boiler and furnace efficiency will depend largely upon full utilization of radiant heat.

PUMPING PLANTS

LAND DRAINAGE. Pumping Plants for Land Drainage, L. C. Craig. Can. Engr., vol. 42, no. 21, May 23, 1922, pp. 525-527. Reclaiming land in Mississippi River valley. electrically-driven centrifugal pumps often used for drainage work; advantage of Diesel engines.

PUMPS

ENDLESS-CHAIN. The "Aquatole" Endless-Chain Pump. Engineering, vol. 113, no. 2948, June 30, 1922, pp. 827-828, 9 figs. Installation of Aquatole liquid [illegible] per [illegible] with driving pulley speed of 350 [illegible] ease of setting up and variety [illegible]

H[illegible] Hy[illegible] vol. no. 1600, June 15, 1922, pp. 573-574, 2 figs. Invention whereby water is lifted through open and closed [illegible]

VALVELESS RECIPROCATING. A Valveless Reciprocating Pump. Colliery Guardian, vol. 123, no. 3206, June 9, 1922, pp. 1420-1421, 4 figs. New type which effects operation of opening and closing inlet and oulet ports by means of alternate axially-reciprocating and rotary-oscillating movements of piston or cylinder itself.

PUMPS, CENTRIFUGAL

EFFICIENCY. Centrifugal Pumps—Notes on Efficiency, E. T. Keenan. Southern Engr., vol. 37, no. 4, June 1922, pp. 39-40, 2 figs. Factors bearing on efficiency of turbine and volute pumps.

SUBMERSIBLE MOTOR. Submersible Motors. Practical Engr., vol. 65, no. 1842, June 15, 1922, pp. 371-372, 2 figs. Extreme portability, lightness and compactness; suction lift of 30 ft.; when pump is working submerged no suction hose or priming is required; advantages of this device.

R

RADIO COMMUNICATION

H.F. AND L.F. AMPLIFICATION. Simultaneous H.F. and L.F. Amplification, P. G. A. H. Voigtt Wireless World; vol. 10, no. 9, May 27, 1922, pp. 249-252, 5 figs. Improvements which eliminate most of troubles experienced when working with dual amplification and construction details.

INSTALLATION RULE REVISION. Radio Installation Rule Revision. Telephony, vol. 82, no. 22, June 3, 1922, pp. 20-22. Tentative rules for installation of radio equipment prepared by special committee of Nat. Fire Protection Assn.; proposed revision of rule 86, Nat. Electric Code, with discussion by Bur. of Standards.

RECEIVING SETS, CLOSED-COIL. Notes on the Design of Closed Coil Receiving Sets, J. Hollingworth. Wireless World, vol. 10, no. 12, June 17, 1922, pp. 351-354, 4 figs. Some new facts about size of coil desirable.

RADIOTELEGRAPHY

SIGNAL STRENGTHS. Reception Measurements at Naval Radio Research Laboratory, Washington, L. W. Austin. Inst. Radio Engrs. Proc. vol. 10, no. 3, June 1922, pp. 158-160. Signal intensity from Bordeaux, Lyons, and Nauen measured by comparison of telephone current with that produced by known audio frequency e.m.f.

RADIOTELEPHONY

TUNING. Fine Adjustments of Tuning for Telephony, G. P. Kendall. Wireless World, vol. 10, no. 10, June 3, 1922, pp. 289-291, 4 figs. Discussion of adjustment of inductance and capacity adjustments for best results.

RADIOTELEPHOTOGRAPHY

TRANSATLANTIC. Transatlantic Radiotelephotography of Writing and Drawings (Radiotelephotographie Transatlantique de textes et de dessins), Edouard Belin. Onde Electrique, vol. 1, no. 5, May 1922, pp. 271-283, 8 figs. Principle of transmission; transmission and reception apparatus; use of Einthoven galvanometer; synchronizing; etc.

RAILWAY ELECTRIFICATION

ADVANTAGES IN U.S. Advantages of Railroad Electrification, R. J. O'Brien. Elec. Jl., vol. 19, no. 6, June 1922, pp. 252-260, 4 figs. Thorough discussion of ability to increase capacity and transportation efficiency of line; examples of installation and further advantages produced therefrom.

CHILEAN STATE RAILWAYS. Electrification of the Chilean State Railways. Engineer, vol. 133, no. 3470, June 30, 1922, pp. 711-714, 11 figs. Utilization of great water power resources for reducing working expenses, increasing traffic capacity and obviating dependence on coal supply from other countries; technical features of problem.

ENGLISH MAIN LINE. The Electrification of English Main Line Railways, Henry Fowler. Instn. Mech. Engrs. Proc., no. 2, 1922, pp. 317-3301 Discussion of paper presented at joint meeting of Instn. Mech. Engrs. Instn. Civil Engrs., and Instn. Elec. Engrs.

JAPAN. Electrification of the Chichibu Railway of Japan, C. A. Bercaw. Ry. Rev., vol. 70, no. 24, June 17, 1922, pp. 911-912, 2 figs. Five 41-ton locomotives shipped by Westinghouse Co., represent first shipment of electric locomotives from America for operation on steam-railroad electrification in Japan.

SWITZERLAND. Conclusion of the Work of Electrification of Rhaetian Railway (Der Abschluss der Elektrifizierungsarbeiten der Rhätischen Bahn) W. Dürler. Schweizerische Bauzeitung, vol. 79, nos. 14, 15, 20, 21 and 22, Apr. 8, 15, May 20, 27, and June 3, 1922, pp. 180-183, 194-198, 249-254, 267-269 and 279-281, 26 figs. Apr. 8 and 15: Discusses power plants at Thusis and Küblis, and their equipment, transmission lines, distributing system, transformers, etc. May 20: Describes the various types of electric locomotive and gives particulars as to their wiring and connecting. May 27: Data of trial runs of locomotives, and heating of trains, June 3: Discusses workshops and engine-houses and their equipment.

VOLTAGES NEAR GROUND. Railway Electrification and Safety Limits of Voltages Near the Ground. Electricity, vol. 36, no. 1649, June 16, 1922, pp. 303-304. Comments on report on comparative tests of different voltages; danger of high voltages at surface.

RAILWAY MOTOR CARS

ADVANTAGES OF. What is the Future or Automotive Rail Cars? L. G. Plant. Ry. Rev., vol. 70, no. 24, June 17, 1922, pp. 930-934, 3 figs. Modern features which are recommended for light local passenger service. From paper read before Soc. Automotive Engrs.

DIESEL-ELECTRIC. Diesel-Electric Motor Cars for Railway Service. Ry. Mech. Engr., vol. 96, no. 6, June 1922, pp. 314-315, 2 figs. Successful operation in Sweden has led to introduction of 250-hp. cars.

492

Gasoline. Some Recent Developments in Gasoline Passenger Rail Cars, W. L. Bean. N.Y. R.R. Club Proc., vol. 32, no. 7, May 19, 1922, pp. 6713-6726 and (discussion) 6726-6744, 6 figs. Considerations which may assist in reducing charges by substituting for light steam trains.

Developments in Gasoline Passenger Rail Cars, W. L. Bean. Ry. Age, vol. 73, no. 1, July 1, 1922, pp. 17-20 (includes discussion), 3 figs. Design, power requirements and operating results of self-propelled cars. (Abstract.) Paper read before N.Y. R.R. Club.

120 Hp. Gasoline Motor Features New Rail Car Design. Ry. Rev., vol. 70, no. 24, June 17, 1922, pp. 934-937, 8 figs. Low maintenance and adaptability to wide range of rail requirements objective in latest automotive development.

Pittsburgh and Shawmut. Operation of Motor Cars on the Pittsburgh and Shawmut, D. C. Morgan. Ry. Rev., vol. 70, no. 24, June 17, 1922, pp. 928-929, 3 figs. Costs less to operate than local steam train; affords better and more frequent service. Paper read before N.Y. R.R. Club.

RAILWAY OPERATION

Train Control. Schweyer Automatic Train Control. Ry. Elec. Engr., vol. 13, no. 6, June 1922, pp. 187-189, 3 figs. Intermittent, non-contact, inert roadside, element type.

The Sprague Train Control System. Ry. Signal Engr., vol. 15, no. 6, June 1922, pp. 226-230, 9 figs. Description of display system of auxiliary control by magnets.

RAILWAY REPAIR SHOPS

Albuquerque, N. M. A. T. & S. F. Ry. Shop Improvements at Albuquerque. Ry. Rev., vol. 70, no. 24, June 17, 1922, pp. 889-896, 16 figs. Engineering and mechanical features of improvement program of largest locomotive erecting shop in West, involving expenditure of about $10,000,000.

Grinding Practice. Railway Shop Grinding Practice in England. Ry. Mech. Engr., vol. 96, no. 6, June 1922, pp. 325-327, 3 figs. Interesting machines developed for grinding locomotive cylinders, car journals and mounted crank-pins.

Passenger-Car. The Design of Passenger Car Repair Shops. Ry. Mech. Engr., vol. 96, no. 6, June 1922, pp. 332-336, 1 fig. Requirements for various departments outlined and typical layouts proposed by A.R.E.A. Committee.

RAILWAY SIGNALING

Automatic. New Signaling on the Big Four, C. F. Stoltz. Ry. Signal Engr., vol. 15, no. 6, June 1922, pp. 221-224, 6 figs. A. C. floating battery installed for operation of 68 miles of double-track automatics shows economy in operation.

Operation, Economy in. Introducing Economies in Signal Operation, Sidney L. Baxter. Ry. Signal Engr., vol. 15, no. 6, June 1922, pp. 231-232, 4 figs. Storage batteries replaced by primary battery, electric lights installed, and maintenance force reduced.

Wires and Cables. Railroad Signal Wires and Cables, Wm. A. Del Mar and F. A. Westbrook. Ry. Signal Engr., vol. 15, no. 6, June 1922, pp. 233-239, 15 figs. Methods of installation and causes of deterioration of rubber insulated conductors.

RAILWAY STATIONS

Waterloo, England. The New Waterloo Station, London and South Western Railway. Ry. Gas., vol. 36, no. 23, June 9, 1922, pp. 919-936, 25 figs. Description of rebuilding of largest station in British Isles and facilities provided.

RAILWAY YARDS

Freight. New Haven Builds Freight Yards at Providence. Ry. Age, vol. 72, no. 24, June 17, 1922, pp. 1467-1470, 4 figs. New terminal forms important unit in broad improvement program to effect operating economies.

REFRIGERATING MACHINES

Condensers, Free-Air. Influencing the Pressure of Free-Air Condensers, M. Hirsch. Ice and Refrigeration, vol. 62, no. 6, June 1922, pp. 457-459, 4 figs. Descriptive article with charts on subject; formula for measuring difference of vapor tension between water surface and moisture contained in surrounding atmosphere; empirical curves for regulation of water and air.

REFRIGERATION

Absorption Process. Refrigeration for the Power Plant, Engineer. Power House, vol. 15, no. 12, June 20, 1922, pp. 31-32, 34, 2 figs. Absorption process of refrigerating; aqua ammonia; general construction and details of parts of machine; few words on operating features.

Absorption System. Outline of the Absorption Refrigerating System, D. L. Fagnan. Power, vol. 55, no. 25, June 20, 1922, pp. 977-979, 2 figs. Discussion of functions of several parts; cycle of events in system; operating procedure to be followed.

RELATIVITY

Theory. Critique of the Theories of Relativity (Critiques des théories de la relativité) P. Juppont. Génie Civil, vol. 80, nos. 19, 20 and 21, May 13, 20, and 27, 1922, pp. 430-431, 443-446 and 468-473, 2 figs. May 13: Discusses relativity and postulates, force, action and reaction, temperature, entropy, May 20: Relativists' solutions of these problems; inadequacy of relativity; Lorentz contractions. May 27: Shows that Einstein's theory is not a physical theory. Physical mechanics; mechanical force and power.

RELAYS

Protective. On the Behavior of a Plunger Type Protective Relay, Y. Toriyama. Denki Galskmai Zasshi Jl. of Inst. Elec. Engrs. of Japan), no. 406, May 1922, pp. 377-390, 19 figs. Study of action of plunger under sudden increase of load current.

493

RESEARCH

Malleable Iron. Malleable Castings Research Laboratory. Iron Age, vol. 109, no. 26, June 29, 1922, pp. 1819-1820, 2 figs. Freedom from routine tests permit concentration on work to advance state of art.

ROAD CONSTRUCTION

Drainage. Comparison of Road Drainage by Deep Side Ditches and Tile Dains, Chas. M. Upham. Mun. and County Eng., vol. 62, no. 6, June 1922, pp. 197-200. Stabilizing subgrades, side ditch and underdrain, comparison of open ditch and tile drain; effect of frost.

Sub-Drainage. Comparison of Sub-Drainage by Deep Side Ditches and Tile Drains. Chas. M. Upham. Contract Rec., vol. 36, no. 22, May 31, 1922 pp. 522-524. Importance of stabilization of road foundations: desirability of combination of ditch and underdrain.

ROAD MATERIALS

Bituminous Sands. Bituminous Sands of Alberta as a Road Building Material Dr. K. A. Clark. Contract Rec., vol. 36, no. 26, June 28, 1922, pp. 603-605. Delivrance of prairies from bad roads may result from discovering how to use bitumen from Athabasca deposits as soil modifier.

ROADS

Improving Improved. Improving Improved Roads in Maryland. Eng. News-Rec., vol. 89, no. 2, July 13, 1922, pp. 56-58, 7 fig. Macadam roads widened at little cost by concrete borders; original structure conserved and modern pavement produced by resurfacing.

Testing of Surfaces, Subgrades and Materials. Developments in the Scientific Testing of Road Surfaces, Subgrades and Materials. Eng. and Contracting, vol. 57, no. 23, June 7, 1922, pp 547-549, 4 figs. Equipment and methods developed for use on Bates and Arlington experimental roads.

Traffic Tests. Results of Heavy Traffic on Pittsburgh Test Road. Eng. News-Rec., vol. 88, no. 26, June 29, 1922, pp. 1066-1069, 4 figs. Trucks travel 96,000 miles; wave motion in concrete slab plotted; moisture percolates slowly in rolled adobe subgrade; tests of wider scope to follow.

Surfaced. Surfaced Roads Would Save $23,000,000, A. W. Campbell. Contract Rec., vol. 36, no. 25, June 21, 1922, pp. 581-582. This amount would be saved to motorists in decreased gasoline consumption alone, quite aside from lower repair expenses; effect of road surfaces and grades on tractive resistance.

ROADS, CONCRETE

Alkali Effect. Alkali Attack on Concrete Roads and Building Brick, Irving Furlong. Eng. News-Rec., vol. 89, no. 2, July 13, 1922, pp. 64-67, 7 figs. Notes on study of disintegration in rice field country of Glenn County in California.

Asphalt Surface. What Is the Best Time to Surface Concrete with Asphalt? W. E. Rosengarten. Contract Rec., vol. 36, no. 25, June 21, 1922, pp. 575-578, 5 figs. Economic study of factors involved in construction of concrete highways with and without asphalt surface; determination of relative expense.

ROLLING MILLS

Electrically-Driven. Steel Rolled for Less on Electric Mills than with Steam Drive, G. E. Stoltz. Elec. World, vol. 80, no. 1, July 1, 1922, pp. 7-10, 2 figs. Records show that steam mills can often be replaced by electric mills with marked advantages; accurate cost accounting is possible with electric mills, and labor and maintenance costs are reduced.

Ship-Plate. The Dominion Iron and Steel Company's New Ship-Plate Rolling Mill, H. E. Rice. Can. Min. Inst. Trans., vol. 23, 1920, pp. 167-178, 5 figs. Description of $5,000,000-installation with its Lauth type 110-in. by 36-in. in three-high plate mill driven by 4,000-hp. 82 r.p.m. special motor.

S

SAFETY

Electric Power Stations. Safety as Applied to Operating Equipment of Large Electric Power Station, E. W. Gorry. Safety Eng., vol. 43, no. 6, June 1922, pp. 261-268. Provisions at plants and sub-stations of United Elec. Light and Power Co. and new Edison Company. Paper read before A.S.S.E.

Safety is Built into the Design of the New Hell Gate Electric Power Station, E. M. Van Norden. Safety Eng., vol. 43, no. 6, June 1922, pp. 257-260. Precautions resulting from knowledge of conditions existing at other stations where trouble has been experienced. Paper read before A.S.S.E.

SAND BLAST

Apparatus. Development of Sand Blast Apparatus in Germany and America (Die Entwicklung des Sandstrahlgebläsebaues in Deutschland und Amerika), W. Kaempfer. Giesserei-Zeitung, vol. 19, no. 19, May 9, 1922, pp. 289-292, 15 figs. Discusses the various types of apparatus and their operation.

SAND, MOLDING

Properties for Steel. Study Properties of Steel Sand. Iron Trade Rev., vol. 71, no. 2, July 13, 1922, pp. 103-106, 8 figs. Facing mixtures must possess highly refractory qualities to resist intense heat of steel at pouring temperatures; determining standards for measuring permeability and strength.

SCRAP

Railway, Reclamation of. Scrap Reclamation on the Chesapeake and Ohio, E. A. Murray. Ry. Mech. Engr., vol. 96, no. 6, June 1922, pp. 308-311, 8 figs. Methods used and savings effected in reclaiming locomotive, car and other parts at Huntingdon shops.

SEPARATORS

[illegible] Magnetic Separator for Low Magnetic Ores (Neue Magnetscheider [illegible]). H. [illegible] Technische Blätter, vol. 12, [illegible] 1922, pp. [illegible] Discusses drum separators for large and small size of grain, and describes their operation.

SEWAGE DISPOSAL

[illegible] The [illegible] of Iron to Activated Sludge, Geo. H. W. Lucas. [illegible] 1922, pp. 131-134. Theories of iron deposition by bacteria; iron precipitated by alkaline sewage; general conclusions.

[illegible] Hydraulics of Dosing Tanks and Trickling Filters, E. E. Sands. Eng. News-Rec., vol. 89, no. 2, July 13, 1922, pp. 67-69, 3 figs. How to design so that settled sewage will be delivered intermittently at uniform rate per sq. ft.

SCREENINGS. The Disposal of Sewage Screenings, Wm. F. Morse. Mun. and County Eng., vol. 62, no. 6, June 1922, pp. 200-201. Continuous incinerator; best method of disposal; increase in quantity.

SEPTIC TANKS. Septic Tanks. Concrete, vol. 20, no. 6, June 1922, pp. 245-246, 7 [illegible] of many types to meet increasing demand in suburban and rural communities.

SHOVELS

ROTARY. The Clere Mechanical Rotary Shovel (Pelle mécanique rotative, système Clere), E. Weiss. Génie Civil, vol. 80, no. 21, May 27, 1922, pp. 477- 479, 8 figs. Describes Clere system for mechanical excavating, loading, etc.

STANDPIPES

DESIGN AND CONSTRUCTION. The Design and Construction of the Gloversville Standpipe, Frank A. Marston. New England Water Works, Assn. Jl., vol. 36, no. 2, June 1922, and (discussion) 334-306, pp. 288-304, (Disc. pp. 304-306) 8 figs. [illegible] equalized under variable requirements by one 1,000,000 gallon standpipe.

STEAM

PRODUCTION AND USE. Economies in Steam-Raising, T. W. Harper. Gas. Jl., vol. 158, no. 3075, Apr. 19, 1922, pp. 154-156. Lancashire versus watertube boilers; boiler settings and flues; feedwater and scale; fuel and grate; waste-heat utilization; superheaters; steam distribution. Paper read before North British Assn. Gas Managers.

PRODUCTION AND UTILIZATION. Commission for the Utilization of Fuels—5th Report (Commission d'Utilisation du Combustible—Cinquième Rapport), V. Krammerer. Annales des Mines, vol. 1, no. 5, May 1922, pp. 348-394. Production and utilization of steam; transportation of steam; steam power and pressure; application of steam in industries.

Work of the Fuel Utilization Commission, V. Kammerer. (Travaux de la Commission d'Utilisation du Combustible.) Bul. de la Société d'Encouragement pour l'industrie Nationale, vol. 134, no. 1, Jan. 1922, pp. 50-78. Report on production and utilization of steam, including transmission, motive power, use of steam for manufacturing and heating purposes, etc. See also Chaleur et Industrie, no. 24, Apr. 1922, pp. 1175-1182.

SUPERSATURATED CONDITION. The Supersaturated Condition as Shown by Nozzle Flow. Prof. A. L. Mellanby. Engineering, vol. 113, no. 2948, June 30, 1922, pp. 832-835, 11 figs. Investigation of flow quantities exceeding those calculated on assumption of isentropic expansion of saturated steam. Paper read before Instn. Mech. Engrs.

STEAM ENGINES

UNIFLOW. The Uniflow Steam Engine Industry. Power, vol. 55, no. 25, June 20, 1922 pp. 960-964, 8 figs. Characteristics of this high-efficiency type which [illegible] development from stagnation.

UNIFLOW LUBRICATION. Lubricating the Uniflow Engine. Practical Engr., vol. 65, no. 1841, June 8, 1922, pp. 363-364. Errors in common practice indicated relieving excessive compression; selection of oil; speed and friction.

STEAM POWER PLANTS

AMSTERDAM. New Steam Plant at Amsterdam. Power Plant Eng., vol. 26, no. 13, July 1, 1922, pp. 639-645, 10 figs. Description of steam-turbine plant with an ultimate capacity of 200,000 hp.; boiler room; electric generating equipment; control equipment.

STEAM TRAPS

SELECTION AND USE. Steam Traps—Their Selection, Installation and Upkeep, E. Smiley. Power, vol. 56, no. 2, July 11, 1922, pp. 45-48. General consideration and method of distinguishing actual leakage of steam from vapor formed [illegible]

STEAM TURBINES

[illegible] Turbine, W. R. Woolrich. Nat. Engr., vol. [illegible] economical [illegible] performance [illegible]

STEEL

[illegible] Iron Age, vol. [illegible] hammer forged metal under static and dynamic stress as produced by direct current and steel [illegible]

ELECTROLYTIC BUILDING UP. A Successful "Putting On" Tool for Steel Parts, David [illegible]

IDENTIFICATION BY SPARK. Steels and Their Sparks. Metal Industry (Lond.), vol. 20, no. 23, June 9, 1922, pp. 549, 551-552, 10 figs. Determining character of steel by examination of sparks given off when sample is held against abrasive wheel.

STAINLESS. Stainless Steels, W. H. Hatfield.Instn. Min. Engrs., Trans. vol. 63, part 3, May 1922, pp. 177-195, 3 figs. Features which make for desirability in mining.

STEEL CASTINGS

MANUFACTURE. The Production of Light Steel Castings. H. Spencer Kipling. Metal Industry, vol. 20, nos. 21, and 22, May 26 andJune 2, 1922. pp. 493, 495 and 525-526. Suggestions for overcoming metal difficulties of making castings for this type.

STEEL, HEAT TREATMENT OF

CARBON- AND CHROMIUM-MOLYBDENUM STEEL. Effect of Heat Treatment on Mechanical Properties of a Carbon-Molybdenum and A Chromium-Molybdenum Steel, H. J. French. Am. Soc. for Steel Treating Trans., vol. 2, no. 9, June 1922, pp. 769-797 and (discussion) 797-798, 17 figs. Summary of results of previous tests and comparison of treatments for production of high resistance to impact and best combination to strengthen ductility.

ANNEALING OVERSTRAINED STEEL. The Efficiency of Annealing Overstrained Steel. I. H. Cowdrey. Am. Soc. for Steel Treating Trans., vol. 2, no. 9, June 1922, pp. 802-808, 3 figs. Tests made to determine extent to which treatment of overstrained steel is successful.

MAGNETIC PROPERTIES, INFLUENCE ON. The Influence of Heat Treatment Upon the Magnetic Properties of Steel. Lancelot W. Wild Am. Soc. for Steel Treating Trans., vol. 2, no. 8, May 1922, pp. 696-704, 6 figs. Intensity of magnetization, permeability, residual induction, and coercive force. Bibliography.

STEEL MANUFACTURE

DIRECT PROCESS. A Direct Method of Steel Manufacture, A. E. Bourcoud. Iron Age vol. 109, no. 20, May 18, 1922, pp. 1349-1351, 3 figs. Discussion of Bourcoud process and possibility of using oil, lignites and other fuels; data on costs. (Abstract.) Paper presented at meeting of Am. Iron and Steel Inst.

STEEL, HIGH-SPEED

TESTS, PHYSICAL. Tests on High-Speed Steels, A. H. D'Arcambal. Iron Age, vol. 110, no. 1, July 6, 1922, pp. 1-5, 7 figs. Transverse and tensile tests of two grades compared; effect of these properties on service of tool.

STEEL WORKS

ELECTRIFICATION. The General Effect of Electrification on the Operation of Steel Mills, W. Sykes. Blast Furnace and Steel Plant, vol. 10, no. 6, June 1, 1922, pp. 306-312. Some interesting figures on operation of mills at Mark Plant are included; writer believes electric power is more economical than steam power.

Calumet Steel Company Electrify Mills, L. H. Hook and F. R. Burt. Blast Furnace and Steel Plant, vol. 10, no 6, June 1, 1922, pp. 313-316, 4 figs. Rotary converter adjustable speed sets at applied to rail rerolling mill; twelve stands of rolls are now electrically driven.

STOKERS

CHAIN-GRATE. A New Chain-Grate Stoker. Mar. Engr and Naval Architect, vol. 45, no. 537, June 1922, pp. 246-247, 1 fig. Mechanical method of coal firing; self-cleaning features; application of chain-grate to marine boilers.

SELECTION. What to Know When Selecting Stoker Equipment, J. G. Worker. Power, vol. 55, no. 17, Apr. 25, 1922, pp. 647-650. Combustion characteristics of principal coals; types of stokers best suited to burn them.

STORAGE BATTERIES

LEAD HYDRATE. Some Reflection on the Lead Hydrate Accumulator, W. R. Cooper, Electrician, vol. 88, no. 2298, June 2, 1922, pp. 654-656, 1 fig. Examination of claims made for new type and consideration of characteristics.

MOTIVE-POWER, CHARGING OF. Automatic Charging of Motive-Power Storage-Batteries, H. M. Beck. Soc. Automotive Engrs., Jl. vol. 10, no. 6, June 1922, pp. 499-506, 10 figs. Storage batteries suitable for propulsion of vehicles, and charts showing results obtained from automatic charge-control.

STREET RAILWAYS

TORONTO'S ROLLING STOCK. Toronto's Progressive Rolling Stock. Elec. Ry. Jl., vol. 59, no. 21, May 27, 1922, pp. 867-870, 10 figs. Toronto Transportation Commission has added 250 new cars to its passenger rolling stock and has remodeled more than 350 other cars.

TURNSTILE CARS. Improvement in Turnstile Cars. Elec. Ry. Jl., vol. 59, no. 19, May 13, 1922, pp. 787-789, 6 figs. One-man operation with double-truck cars in Utica and Syracuse has increased steadily until now Utica has 100 per cent operation. Improvements in turnstile arrangement are described.

STRESSES

ALLOWABLE, SAFETY AND. Factors of Safety and Allowable Stress, C. D. Albert. Am. Mach., vol. 57, no. 2, July 13, 1922, pp. 54-57. Meaning of allowable stress; factors of safety for live and dead loads; effects of fatigue, shock, and uncertainty as to actual conditions existing.

TORSIONAL. Torsional Stresses (Die Lehre der Drehungsfestigkeit), Constantin Weber. Forschungsarbeiten auf dem Gebiete des Ingenieurwesens, no. 249, 1921, 70 pp. 170 figs. Discusses phenomena of torsion, stresses occurring, conditions of equilibrium, internal change of form; develops formulas and makes calcultions; application to various cross-sectins.

TWO-DIMENSIONAL. Some Special Cases of Two Dimensional Stress or ' train, C. E. Inglis. Engineering, vol. 113, no. 2945, June 9, 1922, pp. 732-733, 8 figs. Mathematical consideration in six special cases in plates.

SUBSTATIONS

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[illegible]

[illegible]

CHILE RESOURCES. Sulphur Resources of Chile. Herbert G. Officer. Eng. and [illegible]

SULPHURIC ACID

[illegible] Gilchrist. Chem. and Met. Eng., vol. 26. no. 25. June 21. 1922. pp. 1159-1162, [illegible]

SWITCHBOARDS

[illegible]

T

TAR

[illegible] vatives. W. W. Odell. Bur. of Mines, Dept. of Interior, Technical Paper 268. [illegible]

TANKS

[illegible] Trade Rev., vol. 70. no. 25. June 1922. pp. 1795-1797 and 1806. 3 figs. Man- [illegible]

[illegible]

BELIN SYSTEM. Telegraphic Transmission of Photographs. Nature. vol. 109. no. 2743. May 27. 1922. pp. 687-688. 1 fig. Latest developments in which good [illegible] naval station in United States.

TESTS AND TESTING

[illegible]

TIDAL POWER

UTILIZATION. Utilizing the Power of the Tides and the Motion of the Sea Waves [illegible] tricists. vol. 1. no. 10. May 15. 1922. pp. 73-74. 2 figs. Various schemes for generating power; describes plant at Rennes, in France.

TIMBER

[illegible]

TOLERANCES

STANDARDIZING. Standardizing Tolerances and Allowances in Machine Fits. Am. Mach., vol. 57. no. 2. July 13. 1922. pp. 70-71. Suggestions by A.S.M.E. Sextional Committee on plain gages as compiled from practice of many well- [illegible]

TELEPHONY

REPEATER. Application of Telephone Repeater. H. S. Osborn. Telephony, vol. 82. no. 22. June 3. 1922. pp. 14-20. 8 figs. Technical difficulties in way of general use of telephone repeater; need for large amount of auxiliary apparatus [illegible] West. Soc. of Engrs.

TRANSFORMERS

OIL FOR CIRCUIT BREAKERS AND [illegible] Circuit Breakers. C. J. Rodman. Elec. World, vol. 79. no. 25. June 24. 1922. [illegible]

[illegible]

TRANSFORMERS

[illegible] type.

TRANSPORTATION

[illegible]

TUBES

[illegible]

[illegible] Welding Soc. Jl., vol. 1, no. 3. Mar. 1922. pp. 26-34. 1 fig. Describes simple [illegible]

[illegible]

TUNNELS

[illegible] Line. W. S. McFetridge. Ry. Age. vol. 72. no. 22. June 3. 1922. pp. 1275-1277 [illegible]

TURBINES

[illegible]

TURBO-GENERATOR

[illegible] of Rotherham Corp., having output of 30,000 kw. at 1,500 r.p.m. said to be [illegible]

V

VALVES

EMERGENCY-CLOSING. The Importance of Emergency Closing Valves. P. W. Knauf. [illegible]

Emergency Closing Valves. P. W. Knauf. Refrig. World. vol. 57. no. 5. May 1922. pp. 22-24. 6 figs. Necessity for and types of valve for boiler end of steam pipes.

GATE. [illegible] Gas Age-Rec., vol. 49. no. 20. May 20. 1922. pp. 619-622. 10 figs. Discussion of power-operated valves and review of development of Dean control system for operation of gas. air. steam. water, oil. tar and ammonia gate valves.

Electrification of Gate Valves. Payne Dean. New England Water Works Assn. Jl., vol. 36. no. 2. June 1922. pp. 264-270 and (discussion) 270-272. 5 figs. [illegible] and how valve operating system works.

VENTILATION

PIPES. FRICTION FACTORS. Friction Factors in Ventilating Pipe. W. S. Weeks, W. P. Goss and G. H. Warren. Eng. and Min. Jl.-Press. vol. 113. no. 23. June 10. 1922. pp. 1001-1002. 1 fig. Results of series of experiments at Univ. of Cal. little difference between metal and wood pipe.

VENTURI METERS

ANOMALOUS TEST RESULTS. Anomalous Results in Venturi Flume and Meter Tests. William J. Walker. Eng. News-Rec., vol. 88. no. 19. May 11. 1922. pp. 797-798. 1 fig. Discussion of peculiar variations of venturi coefficients of dis- [illegible]

APPLICATIONS. [illegible] u. Frachtverkehr. vol. 15. no. 11. May 26. 1922. pp. 150-152. 10 figs. Principle and law of venturi tube, its application to measurement of water, steam, gas and air, flow formulas, accuracy, etc.

VIBRATIONS

MEASUREMENT. Apparatus for Studying the Vibrations Produced in Buildings by [illegible] pour l'Industrie Nationale. vol. 134. no. 3. Mar. 1922. pp. 177-186. 7 figs. Holds that a disagreeable element is acceleration and describes principle and oper- [illegible]

W

WASTE HEAT

UTILIZATION. Utilizing the Waste Heat of Flue Gases for Heating and Drying on a Large Scale (Rauchgas-Abwärmeausnutzung für Grossraumheizung und Trocknungsanlagen), Otto Brandt. Wärme- und Kälte-Technik, vol. 24, no. 11, June 1, 1922, pp. 125-127, 5 figs. Use of waste heat for preheating furnace air, feedwater heating, heating of buildings, etc.

WATER

ANALYSIS. Processes of Analyzing Water (Sur les procédés d'analyse des eaux), F. Touplain. Chimie & Industrie, vol. 7, no. 4, Apr. 1922, pp. 634-639, 3 figs. Discusses sampling, physical and chemical methods; concludes that present methods need revising.

WATER GAS

SET CAPACITY, INCREASING. Increasing Water Gas Set Capacity, W. E. Steinwedell. Gas Age-Rec. vol. 50, no. 1, July 1, 1922, pp. 3-4, 3 figs. Consideration affecting changing of set to secure increased capacity according to plan which has been successful at number of plants.

WATER POWER

APPLICATIONS. Water-Power Applications Total 20, 473,548 Hp. Elec. World, vol. 79, no. 21, May 27, 1922, pp. 1072-1073, 1 fig. Federal power commission has received 303 applications for preliminary permits and licenses, and of these had granted 74 up to and including April 17, 1922.

WATER SUPPLY

SAN FRANCISCO PROJECT. San Francisco Water Supply Project, M. M. O'Shaughnessy. Scien. Am. July 1922, pp. 18-19, 5 figs. Bringing 400,000,000 gallons daily by tunnel and pipe lines from Yosemite to San Francisco.

SEWAGE CONTAMINATION PREVENTION. Prevention of Sewage Contamination in Ontario, F. A. Dallys. Can. Engr., vol. 42, no. 21, May 23, 1922, pp. 522-524, What provincial Board of Health is doing to protect water works operated by various municipalities; four divisions of Board's activities. Paper read before Am. Water Wks. Assn.

SOUTH SAANICH, B.C. Water Supply System for the Rural Municipality of South Saanich, B.C., J. B. Holdcroft. Contract Rec., vol. 36, no. 24, June 24, 1922, 550-551, 3 figs. Six-square mile area in which water is being supplied from gravity main which feeds city of Victoria; ten miles of new mains; estimated cost $175,000.

WATER WORKS

BORING, PRELIMINARY. Exploratory Boring Needed as Guide to Design and Construction of Public Works, James F. Sanborn. Eng. News-Rec., vol. 68, no. 25, June 22, 1922, pp. 1024-1028, 6 figs. Subsurface surveys save money and prevent mistakes; boring methods and drill-rig types discussed; preservation of records vital.

WATERWAYS

ST. LAWRENCE SEAWAY. The St. Lawrence Seaway and Its Advantages to This Country, William L. Saunders. Manufacturers Rec., vol. 81, no. 24, June 15, 1922, pp. 57-60. General economic advantages from shipping standpoint.

WELDING

FROGS AND CROSSINGS. Welding Frogs and Crossings with Manganese Steel, H. R. Pennington. Eng. & Contracting, vol. 57, no. 7, Feb. 15, 1922, pp. 152-154, 2 figs. Qualities and methods of use in welding operations. Paper read before Am. Welding Soc.

See also Electric Welding; Electric Welding, Arc; Oxy-Acetylene Welding.

WELDS

TESTING STANDARDS. Standards for Testing Welds. Eng. World, vol. 20, no. 5, May 1922, pp. 297-300, 13 figs. Report of Committee on Standards Tests for Welds of Am. Bureau of Welding , a joint advisory board of Am. Welding Soc. and Eng. Div. of Nat. Research Council, on Welding Research and Standardization.

WIND TUNNELS

MOTOR REGULATOR. Langley Field Wind Tunnel Motor Regulator, D. L. Bacon. Aviation, vol. 12, no. 8, Feb. 20, 1922, pp. 226-227, 1 fig. N.A.C.A. develops motor regulator which practically solves problem of constant propeller speed in wind tunnel. N.A.C.A. Technical Note No. 81.

WIRE DRAWING

CHROMEL WIRE. Drawing Chromel Wire, E. F. Lake. Machy. (N.Y.), vol. 28, no. 10, June 1922, pp. 793-797, 7 figs. Methods of drawing special alloy wire; uses and physical properties of alloy; manufacture of dies.

Drawing Chromel Wire. Machy. (Lond.), vol. 20, no. 508, June 22, 1922, pp. 350-354, 7 figs. Methods of drawing special alloy wire, uses and physical properties of alloy, and manufacture of dies.

WIRE MANUFACTURE

ENGLAND AND FRANCE. Wire Manufacturing in England and France, Kenneth B. Lewis. Blast Furnace & Steel Plant, vol. 10, no. 6, June 1, 1922, pp. 323-325. General comparison of wire drawing practice of England and France with that of United States; reasons for differences in method of manufacture given.

WOOD

TESTING APPARATUS. New Apparatus for Testing Wood, Especially Wood for Aeronautics (Appareils nouveaux pour l'essai des bois), Pierre Breuil. Génie Civil, vol. 80, nos. 19 and 20, May 13 and 20, 1922, pp. 417-422 and 446-449, 17 figs. May 13: Describes Amsler system and apparatus, the Breuil volume meter, and various tests carried out. May 20: Machines for testing wear of woods; Amsler machine for testing propellers.

WOOD PRESERVATION

IMPREGNATION. Practical Experience in Impregnation of Wood (Über praktische Erfahrungen mit Holzimprägniermitteln), Robert Nowotny. Zeit. für angewandte Chemie, vol. 35, no. 37, May 9, 1922, pp. 217-219, 1 fig. Discusses the various methods available and gives tabulation of them, giving name of firm, name of process, composition of impregnating material, durability, etc.

Z

ZINC ALLOYS

BINARY. Studies on the Constitution of Binary Zincbase Alloys, W. M. Pierce. Min. and Metallurgy, no. 182, Feb. 1922, p. 64. Author endeavors to correlate and complete data on constitution of alloys of zinc with other common metals, dealing exclusively with zinc-rich alloys in which zinc content is between 90 and 100 per cent. (Abstract.) See also Am. Min. & Met. Engrs. Trans., no. 1133-N, Feb. 1922, 26 pp. 52 figs. (complete papers.)

ZINC METALLURGY

VAPOR CONDENSATION. Condensation of Zinc Vapors (Sur la Condensation des Vapeurs de Zinc), P. Pierron. Annales de l'Energie, vol. 2, no. 1, Jan.-Feb. 1922, pp. 13-18, 2 figs. Difficulties of condensation of metal to liquid state.

ZINC ORES

ELECTROTHERMIC DRY DISTILLATION. A Proposed Plant for the Electrothermic Dry Distillation of Zinc Ores, Chas. H. Fulton. Eng. and Min. Jl.-Press, vol. 114, no. 1, July 1, 1922, pp. 8-14, 10 figs. Design based on experimental unit operated at East St. Louis; advantages claimed include high recoveries of zinc, adaptability to all types of ores, and lower costs of operation than either retort or electrolytic process.

Engineering Index

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A

ABRASIVE WHEELS

NOMENCLATURE. Grinding Wheel Nomenclature, H. A. Plusch. Machy., (N.Y.), vol. 28, no. 12, Aug. 1922, pp. 979-980, 1 fig. Brief description of various types of wheels.

ABRASIVES

See Emery Paper.

ACCOUNTING

INDUSTRIAL. Present-Day Problems in Industrial Accounting, Stanley G. H Fitch. Jl. of Accountancy, vol. 34, no. 1, July 1922, pp. 1-10. Balance-sheet and its connection with profit-and-loss statement; various other features of industrial accounting.

AIR COMPRESSORS

CENTRIFUGAL. Centrifugal Compressors (Les compresseurs centrifuges). Robert Huguenin. Technique Moderne, vol. 14, no. 6, June 1922, pp. 1921, pp. 241-250, 10 figs. Characteristics of centrifugal compressors for mines. Tests with compressors at Orange-Nassau mines.

INTERCOOLING. Compressor Intercooler Complication, Frank Richards. Power Plant Eng., vol. 26, no. 13, July 1, 1922, pp. 669-670, 2 figs. Moisture in air at different stages of comparison

TRANSFORMERS. Air Transformer Shows Remarkable Efficiency, D. M. McLean. Power House, vol. 15, no. 14, July 20, 1922, pp. 25-26, 5 figs. Description fo device for blowing forge fires and similar purposes.

See also Turbo-Compressors.

AIR CONDITIONING

AIR PURIFIER. The "Vigoratair" System of Air Purification. Eng. Production, vol. 5, no. 95, July 27, 1922, p. 82, 1 fig. Description of details of portable air purifier for factory ventilation. See also Machy. Lond. vol. 20, no. 510, July 6, 1922. pp. 437-438, 2 figs

COOLING BUILDINGS. Cooling of Theatres and Public Buildings, Fred Wittenmeyer. Ice and Refrigeration, vol. 63, no. 1, July 1922, pp. 13-14. Capacities for and methods of cooling theatres; test on air cooling apparatus at Blackstone Hotel; costs.

AIRCRAFT

STRUCTURAL STRENGTH. Structural Strength of Aircraft. Flight, vol. 14, no. 27, July 6, 1922, pp. 385-386. English certificates of airworthiness to be granted only to design meeting specifications in tables shown for general class and for commercial class.

TESTING TO DESTRUCTION. Testing Aircraft to Destruction, Wm. D. Douglas. Aeronautical Jl., vol. 26, no. 138, June 1922, pp. 195-222 and (discussion) 222-230, 36 figs. Examples of certain types of defects which are revealed by strength tests. Necessity for supplementing calculations. Description of present methods.

AIRPLANES

COMMERCIAL. The Design of a Commercial Aeroplane, G. De Havilland. Aeronautical Jl., vol. 26, no. 139, July 1922, pp. 204-211 and (discussion) 211-218. Consideration of this type of engine; construction; stability; passenger accommodations; gasoline systems; controls.

STRENGTH CALCULATOR FOR DETAILS. A Strength Calculator for Aeroplane Details. Flight, vol. 14, no. 23, June 8, 1922, p. 330, 2 figs. Description of slide rule for quickly determining sizes of wiring lugs, bracing attachments, bolts, pins, etc.

ALLOY STEELS

DECOMPOSITION OF MARTENSITE IN. The Decomposition of Martensite Into Troostite in Alloy Steels, Howard Scott. Forging Heat Treating, vol. 8, no. 7, July 1922, pp. 296-299, 3 figs. Only manganese, silicon and chromium show marked effect, first increased intensity of transformation, last two raised its temperature in certain percentages.

TESTS. Heat Tests with Special Steels (Warmversuchemit Souderstählen), H. Edert. Stahl u. Eisen, vol. 42, no. 25, June 22, pp. 961-968, 18 figs. Results of tests made with refined, low-percentage chrome-nickel, chrome-vanadium and non-rustable steels. Investigation includes chemical composition tensible tests, measurements up to maximum temperature of 800 deg. cent., bending tests up to 600 deg., Brinell tests up to 300 deg. and notched-bar tests up to 700 deg.

ALLOYS

ALUMINUM. *See Aluminum Alloys.*

DIAMOND. Diamond Alloy — A New Cutting Metal. Machy. (N.Y.), vol. 28, no. 12, Aug. 1922, pp. 958-959, 2 figs. Alloy composed mainly of chromium, molybdenum and tungsten used for connecting cutting tools.

HIGH-RESISTANCE. Leefurite — High Resistance Alloy. Machy. (Lond.), vol. 20, no. 511, July 13, 1922, pp. 452-455, 5 figs. Description of new alloy metal at 1,500 deg. cent. intended for use as resistance wire.

MAGNESIUM. *See Magnesium Alloys.*

See also Bearing Metals; Monel Metal

ALUMINUM

CASTING. Aluminum Casting and Metal Spraying (Vom Aluminium- und Spritzguss). Zeit. für die gesamte Giessereipraxis, vol. 43, no. 28, July 22, 1922, pp. 393-395. Operations in production of aluminum castings and metal for metal spraying.

CONDUCTORS. The Use of Aluminum in the Electric Industry (L'Emploi de l'aluminium dans l'Industrie Electrique), E. Dusaugey. Société Industrielle de l'Est, Bul. No. 165, Apr.-June 1922, pp. 15-29, 4 figs. on supp. plates, compares mechanical and electrical properties of aluminum, copper and aluminum-steel; examples of overhead aluminum lines.

ALUMINUM ALLOYS

PROPERTIES. Improving Aluminum Alloys (Studien an vergütbaren Aluminiumlegierungen), W. Fraenkel and E. Scheuer. Zeit. für Metallkunde, vol. 14, nos. 2 and 3, Feb. and Mar. 1922, pp. 49-58 and 111-118, 15 figs. Processes of improving aluminum alloys with magnesium content; measuring their conductivity, elasticity, e.m.f., velocity of dissolution; determination of density; experiments with alloys containing Mn; change of tensile strength on prolonged heating; effect of tempering; corrosion.

AMMONIA

SYNTHETIC. New Processes and Proposals for the Production of Synthetic Ammonia (Neue Verfahren und Vorschläge zur synthetischen Gewinnung des Ammoniaks), A. Sander. Zeit. für komprimierte u. flüssige Gase, vol. 22, nos. 1, 3 and 4, 1922, pp. 1-3, 29-32 and 41-43, 2 figs. No. 1: Discusses Haber and Claude processes, and the Hyper-compressor, with which pressures of 1,000 atmos, are reached. No. 2: Discusses Claude process as stated in German patent 341,230, and describes apparatus No. 3: Production of synthetic ammonia in England, America and other countries.

The Synthesis of Ammonia by Means of High Pressures (La Synthèse de l'Ammoniaque par les Hyperpressions), Georges Claude. Société Industrielle de l'Est, Bul. No. 165, Apr.-June 1922, pp. 46-63, 13 figs. partly on supp. plates. Discusses Haber process; simple way of producing high pressures; work of Linde.

AUTOMOBILE ENGINES

CARBURETORS. *See Carburetors.*

MANUFACTURE. Manifacturing Practice on Light Motor-Car Power Units. Machy. (Lond.), vol. 20, no. 512, July 20, 1922, pp. 473-477. Methods of Hotchkiss et Cie. Coventry; deals with heat treatment, case-hardening and refining of stills used.

SLEEVE-VALVE. 10-Hp. Sleeve-Valve Motor-Car Engine. Engineering, vol. 113, no. 2942, May 19, 1922, p. 618, 3 figs. Two-cylinder, horizontally-opposed type made by Vulcan Motor and Eng. Co. which develops 18 b.hp. at 2,000 r.p.m.

AUTOMOBILE FUELS

ALCOHOL-BENZOL TESTS. Testing Alcohol-Benzol Fuel, W. F. Bradley. Motor Transport, vol. 35, no. 905 July 3, 1922, pp. 29-30, 3 figs. Results obtained by Paris Omnibus Co. with over a thousand buses running on 50-per cent mixture.

Tetralite Benzol. Recent Development in Automobile Fuel (Die neuere Entwicklung der Motorkraftstoffe), Wa. Ostwald. Zeit. für angewandte Chemie, vol. 35, no. 46, June 9, 1922, pp. 278-280. Development of explosion and Diesel engines; combustion and mixing of fuels; detailed description and analysis of Reichskrafstoff or tetralite benzol, a mixture of 50 per cent benzol, 25 per cent tetralin and 25 per cent spirits.

AUTOMOBILES

Creeper Track Car. Good Going over Bad Ground Motor Transport, vol. 35, no. 906, July 10, 1922, p. 62, 3 figs. Remarkable performance in this country by Citröen-Kegresse creeper track car.

Transmission Gears. Practical Difficulties in Automatic Transmission Gear Design, P. M. Heldt. Automotive Industries, vol. 47, no. 4, July 27, 1922, pp. 164-165, 1 fig. Describes Andreau gear consisting essentially of internal-type planetary gear with operation controlled by pair of centrifugal weights.

Wheels. How Pressed Steel Wheels are Made, J. Edward Schipper. Automotive Industries, vol. 47, no. 2, July 13, 1922, pp. 71-74, 14 figs. Recent machine-tool developments add to manufacturing efficiency; varied nature of press work shows wide possibilities in pressed-steel production; disk of tapered section is employed.

AVIATION

Aerial Navigation and Instruments. Aerial Navigation and Navigating Instruments, H. N. Eaton. Nat. Advisory Committee for Aeronautics, Report No. 131, 1922, 44 pp., 26 figs. Description of dead reckoning method; natural and artificial horizons and radio direction finder.

Newfoundland and Labrador. Aviation in Newfoundland and Labrador. Aviation, vol. 13, no. 2, July 10, 1922, pp. 41-43, 3 figs. Practical demonstration of value of aerial mail and passenger transport in Arctic countries.

B

BALANCING

Rotating Parts. Balancing Rotating Parts (Sur l'équilibrage des pièces tournantes), C. Feru and J. Labouret. Revue Générale de l'Electricité, vol. 11, no. 25, June 24, 1922, pp. 919-926, 12 figs. Balancing on one and two bearings; determination of angle.

BALLISTICS

Exterior. Exterior Ballistics in Anti-Aircraft Firing and Their Industrial Applications (La balistique extérieure du tir aérien, applications industrielles), Gustave Lyon. Bul. de la Société d'Encouragement pour l'Industrie Nationale, vol. 134, no. 4, Apr. 1922, pp. 327-380, 32 figs. Discusses progress made during war in measuring and determination of trajectories, and describes in detail instruments used. Includes two appendices by Maurie Garnier.

BEAMS

Reinforced-Concrete. Chart for Rapid Calculation of the Minimum Iron Cross-Section in Reinforced-Concrete Beams Under Flexure and Compression or Tension (Graphique pour l'obtention rapide des sections de fer minima, dans une poutre en béton armé, soumise à des efforts composés de flexion avec compression ou tension), E. Gardiol. Bul. Technique de la Suisse Romande, vol. 48, no. 10, May 13, 1922, pp. 113-119, 5 figs. Develops formulas and explains use of chart.

T-Beams Calculation. Charts for Calculating T-Beams Under Flexure (Abaque pour le calcul des poutres en T soumises à flexion simple), R. Coppee. Annales de l'Association des Ingénieur Sortis des Ecoles Spéciales de Gand, vol. 12, no. 1, 1922, pp. 49-53, 2 figs. partly on supp. plate. Develops formulas and explains use of chart.

BEARING METALS

Car and Power-House. Metals for Car and Power House Bearings, H. H. Buckman. Elec. Ry. Jl., vol. 60, no. 2, July 8, 1922, pp. 47-48. Some essential characteristics of satisfactory bearing metal; advantages of using lead base metal. (Abstract.) Paper read before Central Elec. Ry. Assn.

BEARINGS

Casting. Foundry Practice (La Pratique du Réglage), M. Verneret. Fonderie Moderne, nos. 4 and 5, Apr. and May 1922, pp. 97-99, and 143-152, 15 figs. Apr.: Operations connected with casting anti-friction metals direct on to bearing surfaces: nature and choice of anti-friction metals and alloys. May: Utilization of scrap; remelting of metal, fluxes and oxidizing agents; casting; etc.

BEARINGS, BALL

Design. Load on Ball Bearings (Kulelagrets Belastning), F. Symanzik. Teknisk Ukeblad, vol 69, no 23, June 9, 1922, pp 216-218, 3 figs New method for determining size of ball bearings; examples and calculations.

Flour-Mill Equipment. Saving Power in Minnesota Mill. Am. Miller, vol. 50, no 7, July 1, 1922, pp 719-720, 5 figs Ball bearing equipment of Hubbard Milling Co., Manketo; installation of SKF ball bearings on lineshafts which accomplished estimated saving of $3,250 first year.

Roller and. Ball and Roller Bearings in Street-Car Operation and Small Factories (Kugel- und Rollenlager im Strassen- und Kleinbetrieb), Carl Tobias. Zeit. des Osterr. Ingenieur- u. Architekten-Vereines. vol. 74, nos. 11-12 and 15-16, Mar 17 and Apr 14 1922, pp 55-56, and 69-71, 5 figs Mar. 17: Experiments with ball and roller bearings for railway rolling stock; lubrication and its relative cost. Apr. 14: Discusses advantages in saving of lubricants and attention.

BEARINGS, ROLLER

Design and Construction. Rolling Contact Bearings, Tobias Dantzig. Steam, vol. 30, no. 1, July 1922, pp. 3-7. Important requirements of efficiency, capcity, [illegible] self alignment, and ability to maintain perma[illegible] Read before Cincinnati Section A.S M E.

BLAST FURNACES

Sulphur Excess in Slag. Blast Furnaces Difficulties Due to Excessive Sulphur in Slag [illegible] im Hochofen durch Schwefelelend"), A. Killing. Stahl u. vol 42, no. 25, June 22, 1922, pp. 968-971, 3 figs. [illegible] slag. Injurious effect of sul[illegible]

BLOWERS

Blast-Furnace Centrifugal. Centrifugal Blast-Furnace Blowers. Iron and Coal Trades Rev., vol. 104, no. 2833, June 16, 1922, pp. 896-897, 5 figs. Turbo-blowers producing pressures up to 40-lb. per sq. in. and turbo-compressors for higher pressures both transform for energy, half into direct compression and half kinetic energy. Many blast-furnace requirements.

BOILER FEEDWATER

Treatment. Continuous Blowdown and Water Purification Process, M. Kestner. Power Plant Eng., vol. 20, no. 13, July 1, 1922, pp. 647-652, 10 figs. Method of precipitating impurities outside of boiler without loss of heat. (Abstract.) Paper read before British Inst. Mech. Engrs.

Softening of the Boiler Feedwater (Enthärtung des Kesselspeisewassers), P. Martiny. Archiv für Wärmewirtschaft, vol. 3, no. 6, June 1922, pp. 103-110, 7 figs. Action of carbonic acid and oxygen; formation of incrustation and its remedy; describes principal process of treating water.

BOILER OPERATION

Grate Charge. Dependence of Grate Charge on Water Content of Fuel (Die Abhängigkeit der Rostbelastungen vom Wasserstoffgenalt des Brennstoffes), W. Viebahn. Braunkohle, vol. 21, no. 13, June 30, 1922, pp. 258-262, 3 figs. Discusses so-called grate load, i.e., number of kg. of fuel burned per hr. per sq. m. of grate surface and discusses this load for lignite and coal containing different percentages of water.

Humidity and Barometric-Pressure Effects. Effect of Humidity and Barometric Pressure on Boiler Efficiency (Der Einfluss der Luftfeuchtigkeit und des Barometerstandes auf den Kesselwirkungsgrad), L. Finckh. Wärme, vol. 45, no. 23, June 9, 1922, pp. 283-285. Quantity and temperature of air for combustion for lignite, coal and peat; gives table of comparative figures.

See also Peat, Pulverized Coal, Boiler Firing.

BOILERS

Electrically Heated. Regulating Electrode Steam Boilers (Die Leitsungsregelung von Elektrodendampfkesseln), Edgar Zeulmann. Elektrotechnische Zeit., vol. 43, nos. 22 and 23, June 1 and 8, 1922, pp. 759-762 and 784-788, 27 figs. Describes best-known types of electrode steam boilers in which boiler water itself forms electric resistance, and gives their advantages and disadvantages, methods of regulation, etc.

Report on an Investigation of an Electric Boiler Installation (Bericht uber die Untersuchung einer Elektrokesselanlage). Zeit. des Bayer. Revisions-Vereins, vol. 26, no. 10, May 31, 1922, pp. 85-86, 3 figs. Detailed description of boiler installation of a textile spinning and weaving establishment at Blaichach, working on 1000-k.w. polyphase current at 510 volts which has given entire satisfaction.

Maintenance. Recommendations on Boiler Maintenance, A. G. Pack. Ry. Jl., vol. 28, no. 8, Aug. 1922, pp. 19-21. Data from practical experience and suggestions. Welding employed where other means of construction could be more profitably employed. Author is chief inspector of locomotive boilers for U.S. Government.

Testing. The Question of Accurate Boiler Tests, Alfred Cotton. Power House, vol. 15, no. 14, July 20, 1922, pp. 17-20, 2 figs. Attempt to establish accuracy of tests; discussion of various items involved.

BRAKING

Regenerative. An Analysis of Regenerative Braking on Electric Locomotives, C. E. Fiarburn and F. A. Harper. English Elec. Jl., vol. 2, no. 2, Apr.-July, pp. 68-77, 5 figs. Mathematical analyses with curves.

BRIDGES, CONCRETE

Arch. Constructing Arch Ribs of Springfield Bridge. Pub. Works, vol. 53, no. 1, July 1, 1922, pp. 8-10, 5 figs. 35 ribs containing 6,000 cu. yds. of concrete and 1,800 tons of structural steel and supporting floor of 7-span bridge across Connecticut River.

Specifications. Modern Specifications for Concrete Bridge Construction. Can. Engr., vol. 43, no. 2, July 11, 1922, pp. 131-133. Concrete to develop specified strengths but proportions fixed by engineer; joints carefully specified; underwater placing; rubbed finish.

BRIDGES, HIGHWAY

Driveway Surfacing. Surfacing Driveway of Victoria Bridge, Irving H. Parker. Can. Engr., vol. 43, no. 2, July 11, 1922, 125-127, 4 figs. Wooden planking covered with 2-in. sheet asphalt wearing surface; unusually dense, resilient mixture; laying done at night; roadway opened 1½ hours after last load dumped; marks ironed by traffic.

Roadway Platforms. Reinforced-Concrete Roadway Platforms for Iron Bridges (Fahrbahntafeln in Eisenbeton bei Eisernen Brücken), H. Kayser. Bauingenieur, vol. 3, no. 11, June 15, 1922, pp. 325-329, 18 figs. Disadvantages in various methods of construction; calculations and costs.

BRIDGES, LIFT

Italy. New Economical Type of Metal Lift Bridge (Nuovo tipo economico di ponte metallico apribile) Adolfo Rossi, Giornale del Genio Civile, vol. 50, Mar. 30, 1922, pp. 166-174, 9 figs. partly on supp. plates. Describes type of bridge constructed at Caorle, Livenza, with minimum weight in iron and simplest kind of mechanical construction, and gives calculations.

BRIDGES, RAILWAY

Secondary Stresses. An Investigation of Secondary Stresses in the Kenova Bridge, George Alfred Maney and John Ira Parcel. Univ. of Minn. Research Pub., no. 4, May 1922, 51 pp. 25 figs. Analytical investigation of secondary stresses in long simple span railway bridge and experimental verification of same.

BRIDGES, SUSPENSION

Construction. A Rigid Bridge on Suspension Cables (Pont suspendu rigide sur cables), A. Vierendeel. Annales des Travaux Publics de Belgique, vol. 12, no. 5, Oct. 1921, pp. 745-804, 26 figs. on supp. plates. Discusses metal or reinforced-concrete framework, and makes calculations for rigid bridge which under whatever load does not deform more than ordinarily supported bridge.

BUILDING CONSTRUCTION

Mount Royal Hotel, Montreal. The Mount Royal Hotel, Montreal. Contract Rec., vol 36, no. 26, June 28, 1922, pp 620-625, 12 figs., description of 1,000-room hotel now in course of construction being one of largest buildings undertaking on continent.

BUILDING MATERIALS

Testing Machines. New Machines for Testing Building Material. Eng. Progress, vol 3, no 7, July 1922, pp. 157-158, 6 figs Exhibition at last Spring Fair at Leipsic of testing machines for cement and other construction materials which have remarkable constructional features.

BUSES

Trolley. Notes on Railless Electric Traction, E. M. Munro. Tramway & Ry. World, vol. 51, no. 29, June 15, 1922, pp. 287-295, 15 figs. Analysis of principles involved. Data from types of cars in daily service and comparison with tramcars and motor buses. Paper to be read at Congress of Tramways & Light Rys. Assn.

C

CABLES

Potential Gradient. Potential Gradient in Cables, W. L. Middleton, C. L. Dawes, E. W. Davis, Am. Inst. Elec. Engrs. Jl., vol. 41, no. 8, Aug. 1922, pp. 572-584, 23 figs. Description of logarithmic formula; its modifications and effect of internal heat based on results of tests on cables with large ratios of dielectric diameter to conductor diameter.

CABLES, ELECTRIC

Dielectric Losses. Heating of a Cable Through Dielectric Losses (Die Erwärmung eines Kabels durch dielektrische Verluste), H. Schering. Archiv für Elektrotechnik, vol. 11, no. 2, June 10, 1922, pp 68-76, 4 figs. Discusses cables with single core and a.c. cables; calculates excess temperature of conductors above that of sheaths.

Rating. Rating of Cables in Relation to Voltage, Donald M. Simons. Am. Inst. Elec. Engrs. Jl., vol. 41, no. 8, Aug. 1922, pp. 617-626. Prepared at request of Subcommittee on Wires and Cables of Standards Committee of Am. Inst. Elec. Engrs.

Telephone. Philadelphia-Pittsburgh Section of the New York-Chicago Cable, Jas. J. Pilliod. Am. Inst. Elec. Engrs., Jl., vol. 41, no. 8, Aug. 1922, pp. 585-595, 30 figs. Description of telephone cable system over 300 miles in length and connecting Philadelphia and Pittsburgh including recently developed metallic telegraph system.

Underground. The Underground Cable System, William S. Jones. Power Plant Eng., vol. 26, no. 14, July 15, 1922, pp. 712-714. Points to be kept in mind in design and construction of underground systems.

CALORIMETERS

Gas, Integrating and Recording. A Recording and Integrating Gas Calorimeter, C. V. Boys. Gas Jl., vol. 158, no. 3085, June 28, 1922, pp. 882-888, 1 fig. Description of new instrument in which water is allowed to flow from a tank of constant level through nozzle into eccentric bucket, which when overbalanced discharges its contents into water box.

Gas, Recording. Recording Calorific Value of Gas, Gas World, vol. 77, no. 1980, July 1, 1922, pp. 12-13, 1 fig. Fairweather instrument with water-flow Boy's type adapted to record continuously total heat value reduced to standard temperature and pressure.

CAMS

Circumference Formula. Formula for Circumference of Portion of Cam. Machy. (Lond.), vol. 20, no. 513, July 27, 1922, pp. 524-525, 1 fig. Mathematical treatment.

CAR LIGHTING

Electric. Principal Systems of Train Lighting (Les principaux systèmes d'éclairage électrique individuel appliqués aux voitures de chemins de fer), M. Bougrier. Electrician, vol. 38, no. 1304, July 15, 1922, pp. 313-320, 7 figs. Describes electric systems by Stone, Vicarino, and Aichelé, and their apparatus and operation.

Train Lighting (L'Eclairage des trains), H. Guérin. Génie Civil, vol. 81, nos. 1, 2 and 3, July 1, 8 and 15, 1922, pp. 13-15, 36-40 and 59-63, 25 figs. Substitution of electric lighting for systems in use; development of train lighting and its general principles; Brown-Boveri, Dick-E. V. R. Vickers. Etat-E. V. R., Stone, Leitner, Electric Storage Battery Co., and Société de l'Eclairage des Véhicules sur Rails systems; various types of storage batteries.

CAR COUPLINGS

Screw, Railway. Railway Screw Couplings. Ry. Gaz., vol. 37, no. 2, July 14, 1922, pp. 61-62, 1 fig. Test results of nickel-chrome steel coupling for Bengal-Nagpur railway.

CAR WHEELS

Chilled-Iron. Properties of Chilled Iron Car Wheels, George W. Lyndon. Elec. Traction, vol. 18, July 1922, no. 7, pp. 592-594, 2 figs. Association of manufacturers of chilled car wheels and Univ. of Ill. investigate wheel fit and static load strains. Bur. of Standards conducts tests on thermal stresses.

CARS, FREIGHT

Gondola, C. M. & St. P. How the C. M. & St. P. R. R. Designed Their New Gondola Cars. Ry. Rev., vol. 70, no. 23, June 10, 1922, pp. 834-841, 11 figs. Analysis of function of individual members and calculation of stresses involved.

Springs. Spring Assemblages for Freight Car Trucks, Geo. S. Chiles. Ry. Rev., vol. 70, no. 23, June 10, 1922, pp. 844-850, 8 figs. New side frame and bolster design provides higher spring capacity and lower truck weight.

CARS, PASSENGER

6-Wheel Cast-Steel Truck. The Latest Development in 6-Wheel Passenger Trucks Ry. Rev., vol. 70, no. 23, June 10, 1922, pp. 831-833, 6 figs. Pullman Company adopts new design of commercial type with clasp-brake equipment.

CARBURETORS

Adjustment by Gas Analysis. Carburetor Adjustment by Gas Analysis, A. C. Fieldner and G. W. Jones. Jl. Indus. & Eng. Chem., vol. 14, no. 7, July 1922, pp. 594-600, 10 figs. Experimental work on determination of carbon dioxide in exhaust gas, which has direct bearing on carburetor adjustment.

CASE-HARDENING

Steels for. A Comparison of the Rate of Penetration of Carbon into Various Commercial Steels in Use for Case Carburizing, S. C. Spalding. Am. Soc. for Steel Treating Trans., vol. 2, no. 11, Aug. 1922, pp. 950-976, 136 figs. Investigation of straight carbon, chromium silicomanganese, nickel, chromium nickel and chromium molybdenum steels. Curves and photomicrographs.

CAST IRON

Testing Methods. New Methods of Testing Cast Iron, E. V. Ronceray. Metal Industry (Lond.), vol. 20, no. 25, and vol. 21, no. 1, June 23 and July 7, 1922, pp. 586-588 and 13-18, 20 figs. Review of various methods and description of work of Fremont's Transverse testing machine. Paper read before Inst. British Foundrymen.

New Methods of Testing Cast Iron, E. V. Ronceray. Foundry Trade Jl., vol. 26, no. 307, July 6, 1922, pp. 5-12, 19 figs. Fremont's transverse testing machine, shearing tests; M. Portevin's test; elastic limit, modulus of elasticity, sounding and ball tests.

CEMENT

Electric. Electric Cement, Henry J. Harms, Jr. Concrete, vol. 20, no. 6, June 1922, pp. 113-115. Description of French process for producing cement in an electric furnace; superiority of product.

CEMENT MANUFACTURE

Iron and Steel Application. Iron and Steel Application to the Cement Industry, W. R. Shimer. Eng. World, vol. 21, no. 2, Aug. 1922, pp. 93-96. Selection of steels for use in handling cement, particularly heat-treated steel for shovels, gyratories.

CENTRAL STATIONS

France. The Great Thermoelectric Central Station at Comines (La grande centrale thermoélectrique de Comines [Nord]), J. Reyval. Revue Générale de l'Electricité, vol. 12, nos. 2 and 3, July 15 and 22, 1922, pp. 55-68 and 93-105, 34 figs. July 15: One of the most modern stations; has three 25,000-kw units giving normal power of 50,000-kw., one unit being spare; describes boiler-house, machine room and equipment. July 22: Describes pumping station and water intake, 45,000-v. transmission lines, overhead equipment, and underground equipment.

Superpower. The Bavarian Works and Its Sources of Power (Das Bayernwerk und seine Kraftquellen), A. Menge. Elektrotechnische Zeit., special no. May 28, 1922, pp. 2-20, 30 figs. Object of this works is to supply whole of Bavaria with electric power as economically as possible and for this purpose a 110-kv. transmission line has been built, connecting up Munich, Meitingen, Nurenberg, Amberg, Regensburg and Landshut lines; describes masts, insulators, general line equipment, transformers, and switching systems.

CERIUM

Effect on Brass and Iron. Adds Cerium to Brass and Iron, L. W. Spring. Foundry, vol. 50, no. 13, July 1, 1922, pp. 542-544, 2 figs. Effect on red brass is to increase percentage of leaky castings and lower tensile strength and ductility. Shows marked effect on converter steel and causes gray iron to feed better. Paper prepared for convention of Am. Foundrymen's Assn.

CHROMIUM STEEL

Chromium Determination. Rapid Methods for the Determination of Chromium in Steel, A. S. Townsend. Forging and Heat Treating, vol. 8, no. 7, July 1922, pp. 304-305. Oxidation of chromium in acid solution to chromic acid; bibliography.

CIRCUIT BREAKERS

High-Speed. High Speed Circuit-Breakers, Ashton Bremner. Elec. Times, vol. 61, no. 1602, June 29, 1922, pp. 642-643, 5 figs. Tests by oscillograph and high-speed cinematograph by means of reducing current in shorter time than that taken by given commutator per second in traveling from one row of brushes to next.

Oil. Tests on General Electric Oil Circuit Breakers at Baltimore, J. D. Hilliard. Am. Inst. Elec. Engrs. Jl. vol. 41, no. 7, July 1922, pp. 530-535, 6 figs. Developing breaker which would handle short circuit on 13,300-volt, 25-cycle system and show an apparent factor of speed at 25,000 r.m.s. amperes.

Tests on Westinghouse Oil Circuit Breakers at Baltimore, J. B. MacBeill. Am. Inst. Elec. Engrs. Jl. vol. 41, no. 7, July 1922, pp. 537-546, 13 figs. Tests on breakers of different sizes, rupturing capacity ratings ranging from 10,000 amperes to 40,000 amperes at 15,000 volts. Data on tripping speed, length of arc duration and conditions after test.

Quick-Acting. Quick-Acting breakers for Protecting Machines Against Flash (Les disjoncteurs à rupture rapide et la protection contre amorçages d'arcs au collecteur des machines électriques), Candie. Revue Générale de l'Electricité, vol. 11, no. 20, May 20, 1922, pp. 743-752, 18 figs. Detailed description of apparatus, its application to protection of a generator set; its advantages.

COAL

Carbonization. Increasing the Rate of Carbonization, Geoffrey Weyman. Gas Jl., vol. 158, no. 3085, June 28, 1922, pp. 864-868 and (discussion) 868-870, 10 figs. Increases in thermal and volume output per retort of continuous vertical type is usually accompanied by tonnage increase; experimental amplification of observations, coal-testing plant experiments.

Drying. Hoyle Centrifugal Dryer at Tinsley Park Coke Ovens. Colliery Guardian, vol. 123, no. 3209, June 30, 1922, p. 1603, 2 figs. Apparatus in which coal flung outward by centrifugal forces against screens passes down as thin film on inner surfaces of screen while moisture goes through.

Origin. New Contributions on the Origin and Chemical Structure of Coal. Franz Fischer and Hans Schrader. Fuel in Sci. and Practice, vol. 124, no. 3213, July 28, 1922, pp. 114-119. Record of authors' experimental work and development and completion of their theory of origin of coal. Translated from Brennstoff-Chemie.

COAL BREAKERS

Razing and Rebuilding. Razing of Seneca Hoist Tower by Dynamite and Rebuilding of Breaker, Dever C. Ashmead. Coal Age, vol. 22, no. 1, July 5, 1922, pp. 5-8, 8 figs. Dynamite sticks placed in its 10 legs are exploded while locomotive and stump puller pull structure out of perpendicular. Good example of modern breaker of moderate dimensions.

COAL HANDLING

Ash and. Economical Handling of Coal and Ashes. Henry J. Edsall. Can. Manufacturer, vol. 42, no. 7, July 1922, pp. 23-26, 2 figs. Great savings made from installations and recent developments.

Modern Coal and Ash Handling Plant. Gas Engr., vol. 38, no. 554, June 15, 1922, pp. 155-158, 9 figs. Advantages and disadvantages of various types and general points for considera on.

PNEUMATIC. The Pneumatic Handling of Coal H. Blyth. Gas. Engr., vol. 38, no. 554, June 15, 1922, pp. 151-154, 5 figs. Conditions under which satisfactory results may be expected and details of successful installation.

COAL MINES

POWER. The Case Against Use of Purchased Power at Coal Mines, C. W. Smith. Coal Age, vol. 22, no. 1, July 6, 1922, pp. 13-17, 4 figs. Steam hoist with mixed pressure turbine advocated; Power cost is 10c. per ton at Nason Plant. From paper read at Ill. Mining Inst. meeting.

SHAFTS. Study of Stresses and design of Head Sheaves for Coal-Mine Shafts, J. S. Watts. Coal Age, vol. 22, no. 4, July 27, 1922, pp. 127-130, 5 figs. Excessive weight causing slip in rope; effect of lead; cooling action of spokes in casting rim; design of bosses; fit of hub.

COAL MINING

STEAM SHOVEL, ALBERTA. Coal Mining by Steam Shovel in Alberta, Canada, Geo. Sheppard. Inst. Min. Engrs., Trans. vol. 62, pt. 5, June 1922, pp. 323-331, 11 figs. Geological conditions and description of mining operations used in meeting them.

COLD STORAGE

RESEARCH LABORATORY. Cold Storage Research Laboratory. Ice and Refrigeration, vol. 63, no. 2, Aug. 1922, pp. 93-97, 6 figs. Description of laboratory at Canton, Pa., established for purpose of carrying on experiments and reesarch work in storage of perishable products.

COKE

ANALYSIS. The Analysis of Coke, Arthur Grounds; Iron and Coal Trades Rev., vol. 104, no. 2835, June 30, 1922, p. 977. Sampling, moisture, ash, sulphur, phosphorus, calorific value.

ECONOMY FOR STEAM FUEL. Economy of Coke for Steam Fuel. Gas Age-Rec., vol. 50, no. 4, July 22, 1922, pp. 107-108. Coke at $6 cheaper if properly burned for steam raising than coal at $7.

COKE MANUFACTURE

NON-COKING COALS. Good Coke now Manufactured from Non-Coking Coals of Illinois, with Saving of Byproducts, H. A. Patterson. Coal Age, vol. 22, no. 2, July 13, 1922, pp. 45-50, 5 figs. Seek to coke coal before cementing material is oxidized; heat graduated to suit thickness of bed to be coked; coking time lowered to twelve hours; gas introduced at two levels. (Abstract.) Paper read before Ill. Min. Inst.

THEORY. A Recent Theory of Coking, F. V. Tideswell. Fuel in Science and Practice, vol. 123, no. 3208, June 23, 1922, pp. 101-103. Discussion of theory underlying improved process which claims to include bituminous and non-bituminous non-coking coals in coking coals.

COKE OVENS

HEATING WITH BLUE WATER GAS. Heating Coke Ovens with Blue Water-Gas, J. F. O' Malley. Chem. and Met. Eng., vol. 27, no. 2, July 12, 1922, pp. 75-78, 6 figs. Doubles surplus gas from ovens; eliminates carbon from heating flues and permits uniform oven operation without change of burners.

PATH OF GAS TRAVEL. The Foxwell Theory of the Path of Travel of the Gases in the Coke Oven, Gas World, vol. 76, no. 1976, June 3, 1922, p. 10, 1 fig. Laws controlling path found to be similar to those for nest of capillary tubes. Discussion of application.

COMBUSTION

GAS DISTRIBUTION. Study of Distribution of Combustion Gases. Am. Gas Jl., vol. 117, no. 5, July 29, 1922, pp. 89-91, 7 figs. Description of new method of studying diffusion of heat in various apparatus and distribution of combustion gases by means of properties of colored smoke. Model tests compared with phenomena in apparatus in actual operation. From "High-Pressure Boilers" by H. Thoma, Berlin.

SPONTANEOUS. Spontaneous Combustion, Walter L. Wedger. Safety, vol. 9, no. 7, July 1922, pp. 163-168, 1 fig. Various causes and attempts at prevention. Apparatus for testing tendency of cloth. From paper read before Mass. Safety Council of Nat. Safety Council.

COMPASSES

GYROSCOPIC. Theory of the Gyroscopic Compass (Théorie du Compas gyroscopique), P. Lemaire, Technique Moderne, vol. 14, no. 5, May 1922, pp. 202-205, 2 figs. Describes construction and operation and makes calculations in connection with it.

COMPRESSED AIR

STORAGE. Compressed-Air Power Storage (Kraft-Speicheurngs-Anlagen mittels komprimierter Luft), W. E. Trümpler. Schweizerische Bauzeitung, vol. 79, no. 17, Apr. 29, 1922, pp. 222-224, 7 figs. Discusses pneumatic accumulation in place of hydraulic accumulation by compressing air into heat-insulated storage tanks ready for any power use.

CONCRETE

PNEUMATIC PLACING. The Pneumatic Placing of Concrete, Sidney Mornington. Compressed Air Mag. vol. 27, no. 7, July 1922, pp. 191-194, 6 figs. Compressed air solves two difficult problems in lining of tunnels; particularly adapted for use in inaccessible places and also obviates obstruction of traffic.

WEAR TESTS. Wear Tests of Concrete, Duff A. Abrams, Lewis Inst. Structural Materials Research Laboratory, Bul. 10, Dec. 1921, 25 pp., 17 figs. Eleven series of tests on wear as affected by quantities of mixing water; cement; grading of aggregate, hydrated lime, relation of compressive strength of air; age; curing conditions, etc.

CONDENSERS, STEAM

DESIGN. Steam Condensing Plant, D. L. Hall Beama, vol. 10, no. 6, June 1922, pp. 427-436, 4 figs. Items to which careful consideration must be given in designing surface condensers and jet condensers; air leakage and air pumps; condensate [illegible]

CONVERTERS

ROTARY. Rotary Converters and Their Characteristics in Railway Electrification (Les commutatrices et leurs caractéristiques particulières pour leur adaptation à l'électrification des chemins de fer). Industrie Electrique, vol. 31, no. 718, May 25, 1922, pp. 191-194. Frequency; type of machine; importance of a [illegible], etc.

ROTARY ADJUSTABLE-SPEED. Rotary Converter Adjustable Speed Sets, L. H. Hook and F. R. Burt. Power Plant Eng., vol. 26, no. 13, July 1, 1922, pp. 659-663, 8 figs. Application to rail rerolling mills of Calumet Steel Co. (Abstract.) Paper read before Assn. Iron and Steel Elec. Engrs.

CORROSION

PREVENTION. Fighting Corrosion as a Major Source of Waste in Industry, R. H. Hubbell. Jl. Elec. and West. Industry, vol. 49, no. 1, July 1, 1922, pp. 9-11, 7 figs. Choice of proper coating; paints that injure metal.

Mechanism of Metallic Oxidation at High Temperatures, N. B. Pilling and R. E. Bedworth. Chem. and Met. Eng., vol. 27, no. 2, July 12, 1922, pp. 72-74. Rapidity due to combination of physical properties of oxide and its ability to absorb and diffuse oxygen rather than to any property of metal itself. Paper read before Am. Inst. Min. and Metallurgical Engrs.

Oxididation of Steels and Their Use in Degasification of Water (Sur l'oxydabilité des aciers et leur utilisation au dégazage de l'eau), G. Paris. Chaleur et Industrie, vol. 3, no. 25, May 1922, pp. 1259-1261, 1 fig. Discusses dependence of oxididation of steels on their crystalline structure and proposes special alloys for fixing oxygen in water.

CRANES

TRAVELING. Lifting Apparatus (Appareils de levage), Legrand-Ribet. Outillage, vol. 6, nos. 24, and 25 June 17 and 24, 1922, pp. 765-767, and 787-791, 9 figs. June 17: Calculations and specifications of an electric traveling crane of 10,000 kg. capacity at 20m. radius of action, with hoisting speed of 6 m. per min. June 24: Describes frame-work of crane and calculations for it.

CUTTING TOOLS

See Alloys, Diamond.

D

DAMS

CORE-WALL CONSTRUCTION. Core-Wall Construction in Deep Trench at Wanaque Dam, Arthur H. Pratt. Eng. News-Rec., vol. 89, no. 3, July 20, 1922, pp. 92-95, 7 figs. Trenching and concreting plant and methods for trench 900 ft. long, 90 ft. deep, and 20 ft. wide.

HETCH HETCHY, SAN FRANCISCO. The Hetch Hetchy Dam. Pub. Wks., vol. 53, no. 2, July 8, 1922, pp. 21-23, 5 figs. San Francisco's 135-billion-gallon concrete dam ,430 ft. high, 298 to 900 ft. wide, and 117 ft. below bed of stream.

MASONRY. Hollow Triangular Masonry Dams With Counterforts at Regular Intervals (Barrage triangulaires evides en maçonnerie à contreforts régulièrement espacés), R. Tavernier. Annales de l'Energie, vol. 2, nos. 2 and 3, Mar.-Apr. and May-June 1922, pp. 41-46 and 85-94, 5 figs. Mar.-Apr. Discusses conditions of stability and makes calculations. May.-June: Gives tables and diagrams and shows how to use them for determining thickness of counterforts.

MULTIPLE-ARCH. Multiple-Arch Dam on the Tirso, Sardinia [Barrage à voutes multiples, sur le Tirso, à San Chiara d'Ula (Sardaigne)]. Génie Civil, vol. 81, no. 2084, July 22, 1922, pp. 77-82, 12 figs. Describes construction work in course of completion for hydroelectric plant producing 30,000 hp. which power is to be used especially for mining purposes.

DIES

SELF-OPENING, CHASERS FOR. Making Chasers for self-opening dies. Am. Mach. Vol. 57, No. 5, Aug. 3, 1922, pp. 169-174, 16 figs. Mining blocks to form and size; cutting threads by means of hobs; hand and machine tapping methods.

DIESEL ENGINES

DESIGN. Variations in Modern Diesel-Engine Design, Thos. Orchard Lisle. Soc. Automotive Engrs. Jl., vol. 11, no. 1, July 1922, pp. 92-106, 36 figs. Unfavorable comments on tendency to depart from original Diesel designs.

VALVES. Care of Valves on Diesel Engines, L. R. Ford. Power, vol. 56, no. 6, Aug. 8, 1922, pp. 204-206, 4 figs. General discussion.

DIRECTION FINDERS

NAVIGATION. Radio Direction Finding, F. W. Dunmore. Pacific Mar. Rev., vol. 19, no. 7, July 1922, pp. 404-407. Methods of radio direction finding as aid to navigation; relative advantages of locating finder on shore and on shipboard.

DRILLING MACHINES

DESIGN. Effect of Design on Drilling Machine Efficiency, F. E. Johnson. Machy. (N.Y.), vol. 28, no. 12, Aug. 1922, pp. 964-967, 6 figs. Important factors in design and operation. Suggestions for improving operative conditions.

DUST

COLLECTION. Designing a Dust-Collecting System, H. M. Nichols. Wood-Worker, vol. 41, no. 4, June 1922, pp. 50-51. Principles which must be considered in planning efficient exhaust system for woodworking plant.

DYNAMOMETERS

BRAKE. Measuring Electric Power by the Brake Dynamometer (Mesure de la puissance des moteurs électriques au moyen des dynamos dynamomètres), M. Marre. Electricien, vol. 53, no. 1300, May 15, 1922, pp. 222-227, 8 figs. Construction and operation of brake dynamometer, its application in testing, friction losses, etc.

E

ECONOMIZERS

PERFORMANCE. Notes on Economizer Performance, A. W. Binns. Power Plant Eng., vol. 26, no. 14, July 15, 1922, pp. 694-697, 5 figs. Losses, methods of testing, obtaining standards and maintenance.

ELECTRIC CIRCUITS

SUPER-REGENERATIVE. A Further Development of the Armstrong Circuit, Edgar H. Felix. Wireless World, vol. 10, no. 17, July 22, 1922, pp. 503-506, 3 figs. Description of super-regenerative circuit and its adjustments.

ELECTRIC FURNACES

Brass and Bronze. Electric Melting Furnaces for Brass and Bronze, Howard McLean and John M. Boyd. West Machy World, vol 13, no 7, July 1922, pp. 244-246, 4 figs. Commercial uses for electric furnace and description of various types; some considerations of comparative melting costs.

Resistance. Wire and Ribbon Wound Resistance Furnaces, Charles C. Bidwell. Sibley Jl. of Eng., vol 36, no 6, June 1922, pp 119-121 and 129. Temperature range determines choice of resistor refactory and thermal insulation; temperature distribution determines shape of furnace, manner of winding, heating elements and placing thermal insulation

Single-Phase. Single-Phase Electric Furnace, H. P. Abel, A. A. Liardel and W. West. Iron & Steel of Canada, vol. 5, no. 7, July 1922, pp. 128-130. Advantages of single-phase furnaces; drawback of bad effect of power factors; details of construction and operation.

Steel. A New French Electric Furnace for Steel Foundry, R. Sylvany. Can. Foundryman, vol. 13, no. 7, July 1922, pp. 28-29. Constructed with idea of insuring good purification by direct passage and uniform distribution of current through metal and slag.

Fiat Electric Steel Furnace, Dr. Alfredo Stromboli. Chem. and Met. Eng., vol 27, no 1, July 5, 1922, pp 28-30, 5 figs. Description of fast furnace of large output with tight roof maintained by special economizer.

Sweden. Electric Smelting and Blast-Furnace Installations in Porjus (Sweden) (De elektriska smältverks- och masugnsanläggningarna i Porjus) Gunnar Herlin. Jernkontorets Annaler, vol. 106, no. 4, 1922, pp. 99-132, 22 figs. Detailed description of plant layout, buildings, electrical and other equipment, furnaces, etc.

ELECTRIC METERS

Ohmmeters and Capacimeters. Direct-Reading A.C. Ohmmeters and Capacimeters (Ohmmètres et capacimètres à courant alternatif à lecture directe), R. Barthelemy. Revue Générale de l'Electricité, vol. 11, no. 24, June 17, 1922, pp. 891-894, 4 figs. Direct measurement of a.c. capacities and weak resistances. Describes ohmmeters and capacimeters made by Fabrication des Compteur-Co., including two types of capacimeters, one machining several microfarads, and other permitting direct reading of small capacities, used especially in high frequencies.

Outdoor. Cost of Outdoor Metering Installations, Halbert R. Thomas. Elec. World vol. 80, no. 3, July 15, 1922, pp. 119-121, 3 figs. Data for 2,200-volt, 10,000-volt, and 15,000-volt installations of Southern California Edison Co.; features of construction.

Testing. An Arrangement for D.C. Meter Testing, J. B. Willingham. Elec. Rev., vol. 91, no. 2331, July 28, 1922, pp. 114-116, 2 figs. Description of testing board for d.c. meters and resistances for d.c. meter testing.

ELECTRIC MOTORS

Induction. Synchronized Asynchronous Motors (Les Machines asynchrones synchronisées), E. Manc. Technique Moderne, vol. 14, no. 6, June 1922, pp. 250-255, 17 figs. Discusses starting and operating characteristics of this motor used with view to reducing price of kw-hr by raising power factor.

Power Required. A Method of Determining Resultant Input from Individual Duty Cycles and of Determining Temperature Rating, Bassett Jones. Gen. Elec. Rev. vol. 25, no. 7, July 1922, pp. 405-417, 10 figs. Comprehensive mathematical method based on theory of probabilities which will furnish complete analysis of all data necessary to make intelligent selection of generating and transmission equipment for group of motors.

ELECTRIC RAILWAYS

Austria. Electric Working of Austrian Railways (Der elektrische Betrieb auf den Oesterreichischen Bundesbahnen), E. E. Seefehlner. Elektrotechnische Zeit., special no., May 28, 1922, pp. 41-44, 5 figs. Discusses hydroelectric developments and describes new single-phase a.c. locomotives 1C + C1.

Napa Valley, California. The Napa Valley Route Elec. Ry. Jl., vol. 60, no. 1, July 1, 1922, pp. 7-8, 5 figs. San Francisco, Napa & Calistoga Ry., is successful single-phase California electric system; in connection with boat line it offers through service to San Francisco.

Temperature Effect on Power Consumption. Relation Between Temperature and Power Used by Electric Cars, A. W. Baumgarten. Elec. Ry. Jl., vol. 60, no. 3, July 15, 1922, pp. 77-78, 3 figs. Tests indicate that more power is used during cold weather; present methods of lubrication appear to be responsible for large part of increase.

ELECTRIC TRANSMISSION LINES

Calculation. Alignment Charts for the Mechanical Calculation of Overhead Electric Transmission Lines (Nomogrammes pour les calculs mécaniques des lignes aériennes de transmission d'énergie électrique), A. Joitel. Revue Générale de l'Electricité, vol. 12, no. 1, July 8, 1922, pp. 5-14, 6 figs. Calculation in connection with conductors, length, voltages, etc., gives examples.

Mechanical Calculation of Overhead Electric Transmission Lines (Note sur les calculs mécaniques des lignes aériennes de transmission d'énergie électrique), A. Joitel. Revue Générale de l'Electricité, vol. 11, no. 26, July 1, 1922, pp. 949-957, 5 figs. Calculation of conductors, their cross-section, voltages, excess voltages; explains method of calculation.

Mechanical Calculation of Transmission Lines (Calcul mécanique des lignes aériennes), A. Auric. Technique Moderne, vol. 14, no. 5, May 1922, pp. 200-202, 2 figs. Mechanical and electrical properties of aluminum, copper, aluminum steel, and steel. Develops formulas and gives examples of calculations.

Crossing of High- and Low-Tension. Crossings of High-Tension and Low-Tension Lines (Krydsning mellem Höjspaendings-Luftledninger og Svagströms-Luftledninger). Teknisk Tidsskrift (Elektroteknikeren), vol. 18, nos. 11 and 12, May 31 and June 14, 1922, pp. 69-76 and 77-80, 10 figs. May 31: Gives rules formulated by Danish Electricity Commission to be observed in construction of lines, including general and safety rules. June 14: Comment by Gunnar Kjaer.

Economical Construction. Economical Transmission Line Construction, E. V. Pannell. Denki Gakkwai Zasshi (Jl. Inst. Elec. Engrs. of Japan), no. 407, June 1922, pp. 452-469, 10 figs. Copper, aluminum and aluminum steel tried out on 130-kv. line carrying 60,000 kw. over 150 miles. General conclusion favors latter.

60,000-Volt. 60,000-Volt Transmission Line From Cape Volturne to Naples (La linea di transmissione a 60,000 volt da Capo Volturno a Napoli con isolatri sospesi), Elettrotecnica, vol. 9, no. 16, June 5, 1922, pp. 365-366, 3 figs. Line equipment, insulators, conductors, poles. etc.

ELECTRIC WELDING

Electropercussive. Review of Electro-Percussive Welding, D. F. Miner. Am. Welding Soc. Jl., vol. 1, no. 7, July 1922, pp. 27-36, 36 figs. Description of process and examples of welding.

Theories of. Theories of Electric Welding. Practical Engr., vol. 66, no. 1845, July 6, 1922, pp. 5-6. Electrodes of future; carbon; brittleness; harmful elements.

ELECTRIC WELDING, ARC

Cyc-arc. The "Cyc-arc" Process of Automatic Electric Welding in Ship Work, L. J. Steele and H. Martin. Electrician, vol. 89, no. 2306, July 28, 1922, pp. 98-99, 3 figs. Recent developments. Success in making mild-steel welds.

Monel Metal. Arc Welding Monel Metal, P. D. Merica and J. G. Schoener. Welding Engr., vol. 7, no. 7, July 1922, pp. 42-44 and 46, 6 figs. Use of metallic deoxidizers has resulted in sound, strong, and moderately ductile welds. From paper read before Am. Welding Soc.

ELECTRICAL APPARATUS

Temperature Measurement. Determination of Temperature of Electrical Apparatus and Cables in Service, E. J. Rutan. Am. Inst. Elec. Engrs., Jl. vol. 41, no. 6, June 1922, pp. 464-469, 7 figs. Discussion of methods applicable to light and power company work and characteristics of measuring apparatus.

ELECTRICAL MACHINERY

Rating Standards. Questions Relating to Standards of Rating, with Particular Reference to Large Machines Using Class B Insulation, F. D. Newbury. Am. Inst. Elec. Engrs. Jl., vol. 41, no. 7, July 1922, pp. 527-529. Basic principles of rating; limiting temperatures for class B insulation; consideration of performance standards from testing and operating instructions; application of embedded detector method of temperature measurement.

Temperature Measurement. Measuring the Temperature of Electric Machinery (Misura delle Temperature nel macchinario elettrico), G. Keinath. Elettrotecnica, vol. 9, no. 20, July 15, 1922, pp. 443-446, 8 figs. Importance of measuring temperature; where and how to measure it; causes of errors in measurement.

ELECTRICITY

Matter and. Electricity and Matter, Ernest Rutherford. Electrician, vol. 88, no. 2301, June 23, 1922, pp. 742-743. Kelvin Lecture in which review of recent advances in art, knowldege, and relations between electricity and matter is given. Consideration of constitution of atoms. (Abstract.) Lecture before Instn. Elec. Engrs.

Tribo-Electricity. The Nature of Tribo-electricity or Electricity of Friction and Other Kindred Matters, Elihu Thomson. Genl. Elec. Rev., vol. 25, no. 7, July 1922, pp. 418-421. Review of work of pioneers and results of recent investigations into electricity of friction. Based on Lecture before A.I.E.E.

ELECTROCHEMICAL INDUSTRY

Methods and Future. The Electrochemical Industries — Their Methods and Future (Les Industries Electro-Chimiques — Leurs méthodes, leur avenir), Charles Blanchet. Revue de l'Ingénieur et Index Technique, vol. 29, nos. 1 and 2, July and Aug. 1921, pp. 11-16 and 51-62, and France Belgique (Formerly Revue de l'Ingénieur et Index Technique), vol. 1, nos. 3, 4, 5 and 6, Mar., Apr., May and June 1922, pp. 118-128, 189-198, 255-266 and 318-331, 9 figs. July: Electric furnace products; when to use electric furnace. Aug.: Types of electrode furnaces; consumption of current. Mar.: Electrolysis and electrolytic methods. Apr.: Griesheim-Elektron process; Allen-Moore and Nelson electrolyzers. May: Raw materials and principal products of electrochemical industry; consumption of power and anodes; electrolysis of heavy metal salts. June: Production of electrolytic iron; refining of nickel; manufacture organic products by electrolysis; modern production of aluminum.

ELECTROLYSIS

Water Mains. A History of the Corrosion of the 36-inch Steel Force Maine at Akron, Ohio, G. Gale Dixon, and Investigation of Electrolysis on Steel Force Maine at Akron, Ohio, Victor B. Phillips. New England Water Works Assn. Jl., vol. 36, no. 2, June 1922, pp. 157-169, and 179-180, and (discussion) 181-188, 7 figs. First Article: Mention of several well known cases; details of severe corrosion after 5 years on one-mile stretch of 11-mile lockbar steel force main at Akron. Second Article: Investigation of following causes of corrosion: railway current, soil corrosion, small local galvanic currents.

ELECTROMAGNETIC WAVES

Theory. Address to the Wireless Society of London, Sir Oliver J. Lodge. Wireless World, vol. 10, no. 14, July 1, 1922, pp. 407-415, 6 figs. Discusses ether in connection with electric and electromagnetic waves, including Maxwell's theory, Hertzian waves, and author's own work.

EMERY PAPER

Manufacture. Improving Emery Paper (Metod för förbättring av smärgelpapper), C. Benedicks and E. Sörberg. Jerkontorets Annaler, vol. 106, no. 5, 1922, pp. 178-185, 10 figs. Describes production under pressure and gives results obtained.

ENGINEERING SCHOOLS

Curricula, Criticism of. Engineering Schools Fall Short of Modern Needs, John H. Dunlap. Eng. News-Rec., vol, 89, no. 6, August 10, 1922, pp. 221-226. Criticisms of present methods; suggests longer course for engineering degree. Author is secretary of Am. Soc. Civil Engrs.

ENGINEHOUSES

Concrete-Unit. Concrete-Unit Roundhouses on the Pennsylvania R.R. Eng. News-Rec., vol. 89, no. 3, July 20, 1922, pp. 110-112, 3 figs. Large buildings framed of precast members; walls of brick and steel sash; casting yard and unit erection methods.

Southern Pacific. Southern Pacific Builds Unique Engine Houses. Ry. Age, vol. 73, no. 3, July 15, 1922, pp. 105-106, 2 figs. Rectangular concrete structures are provided with lead tracks at each end to expedite use.

EVAPORATION

Problems. The General Problem of Evaporation, J. W. Hinchley. Soc. Chem. Industry Jl., vol. 41, no. 14, July 31, 1922, pp. 242T-246T, 3 figs. Study of evaporation below boiling point of liquid evaporated and evaporation at boiling point.

EXCAVATION

Cost Estimation. Estimating the Cost of Excavating, Chas. F. Dingman. Contract Rec., vol. 36, no. 27, July 5, 1922, pp. 662-664. Factors involved and production units applying thereto; details of method of computing estimate of excavating operations.

EXCAVATORS

Pneumatic Clay Diggers. Pneumatic Clay Diggers Speed Sewer Tunnel Excavation. Contract Rec. vol. 36, no. 24, June 14, 1922, pp. 559-561, 1 fig. Development of air-driven tools, eliminating picking or blasting, makes possible record progress in tunnel driving.

EXTRUSION OF METALS

Process. Extrusion of Metals (Quelques lois expérimentales de l'écrouissage), L. Poitrinal. Technique Moderne, vol. 14, no. 5, May 1922, pp. 193-199, 6 figs. Different ways of deformation; determination of parameters required; extrusion by compression, traction and compression and traction simultaneously.

F

FACTORIES

Location. Industrial Plants and Their Location, F. Theo Gnædinger. Eng. Inst. Canada Jl., vol. 5, no. 7, July 1922, pp. 354-358, 4 figs. General survey of principal features to be considered in locating, designing and constructing industrial plant.

FATIGUE

Industrial. Fatigue in Industry (Le Problème de la fatigue dans l'Industrie), Jean Waldsburger. Vie Technique et Industrielle, vol. 3, nos. 31 and 32, Apr. and May 1922, pp. 25-27 and 95-97, 5 figs. Apr.: Research work of Prof. Kent, in England on study of fatigue in men and women workers, and instruments used for measurements. May: Research work of J. M. Lahy, in France.

FEEDWATER HEATERS

Locomotive. Practical Advantages of Locomotive Feed Water Heating. Ry. Rev., vol. 70, no. 23, June 10, 1922, pp. 825-830, 6 figs. Maintenance and operation of locomotive feedwater heaters on 14 railroads. Int. Ry. Fuel Assn. report.

FIRE PREVENTION

Water Works Co-operation. How the Water Works Should Aid in Fire Fighting, Clarence Goldsmith. Fire and Water Eng., vol. 72, no. 1, July 5, 1922, pp. 7-8. Suggestions as to active co-operation between water and fire departments; water-works employees should answer alarms; hydrant inspection; matter of adequate pressure.

FLOW OF WATER

Measurement. Methods and Apparatus for the Photometric Gaging of the Flow of Water (Procédés et appareillage pour le jaugeage photométrique de faibles cours d'eau), Paul P. E. Papadopoulo-Santo Rini. Annales de l'Energie, vol. 2, no. 3, May-June 1922, pp. 97-101, 11 figs. Describes method consisting of introduction of liquid color at one point and photometric determination of color on water at a given distance at a certain time.

The California Pipe Method of Water Measurement, Blake R. Vanleer. Eng. News-Rec., vol. 80, no. 5, Aug. 3, 1922, pp. 190-192, 3 figs. Description of apparatus used and its operation; tables and charts employed.

FLUE-GAS ANALYSIS

Apparatus for. A New Flue Gas Tester, Max Moeller. Eng. Progress, vol. 3, no. 7; July 1922, pp. 151-152, 3 figs. Instrument based on variation in heat conductivity of flue gases produced by alteration of CO_2 content by electrical means.

Automatic Carbon Dioxide Indicator for Flue Gas, R. B. MacMullin. Jl. Indus. and Eng. Chem., vol. 14, no. 7, July 1922, pp. 628-629, 2 figs. Description of instrument accurate to 0.02 per cent, which will record continuously for two days or more without need of refilling scrubber or readjusting zero point.

FORGINGS

Brass. Brass Forgings, C. G. Heiby. Metal Industry (Lond.), vol. 21, no. 2, July 14, 1922, pp. 25-27. Description of process; sand-cast blanks; chill-cast blanks, composition of metal, physical properties.

Hammers, Pneumatic. "Single-Blow" Pneumatic Forging Hammers, W. H. Snow. Engineering, vol. 114, no. 2952, July 28, 1922, pp. 98-101, 9 figs. Discussion of efficiency of operation, special reference to weight and duration of blow.

Steel for. Scientific selection of Materials for Forgings. Am. Mach., vol. 57, no. 6, Aug. 10, 1922, pp. 211-215, 10 figs. Selection of steel; its testing and heat treatment.

FOUNDRIES

Compressed Air in. Compressed Air in the Foundry, L. W. Schnitzer. Compressed Air Mag., vol. 27, no. 7, July 1922, pp. 185-188, 8 figs. Pneumatic devices perform many useful operations in foundry; reduce costs and increase production.

Layout. Modern Tendencies in Foundry Installation (Tendances modernes présidant à l'installation des Fonderies), M. Thomas. Fonderie Moderne, no. 5, May 1922 pp. 129-141, 4 figs. Foundries for heavy, medium, and mechanical castings; foundry sand; etc.

Malleable-Iron. Brass Firm Makes Malleables, Pat Dwyer. Foundry, vol. 50, no. 13, July 1, 1922, pp. 523-528, 10 figs. Powdered coal equipment for [illegible] 100,000 sq. ft. of floor space and all modern improvements in sanitation, safety devices, dust exhaust system, etc.

Planning a New Malleable Shop, E. Touceda. Iron Trade Rev., vol. 71, no. 4, July 27, 1922, pp. 243-248, 3 figs. Consideration governing site selection and plant [illegible] equipment. (Abstract) Exchange paper before Inst. British Foundrymen.

Safety. Safety Work in Foundries, R. W. Patmore. Metal Industry (Lond.), vol. 20, no. 25, and vol. 21, no. 1, June 23 and July 7, 1922, pp. 584-585 and 3-4. Also Foundry Trade Journal, vol. 25, no. 305, June 22, 1922, pp. 464-467. Analysis of causes of major and minor accidents in foundry and suggestions for [illegible]. Presented at Inst. British Foundrymen.

FRAMES

Kinematic Theory of [illegible] Framework (Théorie cinématique des [illegible]), [illegible] vol. 81, no. 2, July 8, 1922, pp. 40-43, 18 figs. Develops formulas and [illegible] calculations.

FUEL ECONOMY

Power Plants. Fuel Economy in Steam Power Plants, John B. C. Kershaw. Beama vol. 11, no. 1, July 1922, pp. 474-481, 3 figs. Composition and constitution of natural and artificial fuels, and chemistry of conbustion process.

Fuel Economy and Production Expenses, Allen M. Perry. Elec. World, vol. 80, no. 3, July 15, 1922, pp. 115-118. Data given for electric plants burning coal, oil, gas and hogged fuel; careful analysis of data permits interesting comparisons between results obtained.

FUELS

Garbage. Burning Garbage Under the Boiler (Die Verwertung von Müll durch Verbrennung), H. Hermann. Gesundheits-Ingenieur, vol. 45, nos. 2 and 26, May 27 and June 30, 1922, pp. 274-278 and 339-343, 12 figs. May 27: Furnaces fired with garbage and other refuse, especially for hot water and heating purposes. June 30: Garbage incinerating plants, their operation and equipment.

Sawdust. Sawdust as Fuel. Elec., Rev., vol. 89, no. 2282, Aug. 19, 1922, pp. 236-238, 8 figs. Details of plant installed by John Sadd & Sons, Ltd., Maldon, Essex, for production of gas from sawdust.

See also coal, coke, oil fuels, peat, pulverized coal.

FURNACES, HEAT-TREATING

Continuous. Continuous Furnaces and Their Application, P. J. Myall and L. A. Mekler. Forging and Heat Treating, vol. 8, no. 7, July 1922, pp. 322-326, 5 figs. Classification of continuous furnaces; type of furnace recommended for various operations; writers believe there should be ten continuous furnaces for one now in operation.

Scale Formation. Furnace Atmospheres and Their Relation to the Formation of Scale, George C. McCormick. Am. Soc. for Steel Treating Trans., vol. 2, no. 11, Aug. 1922, pp. 1006-1012, 3 figs. Experimental data and procedure during investigation of scaling activity of oxidizing, neutral and reducing atmospheres during heat treatment of steel.

FURNACES, BOILER

Air Preheaters. Air Preheaters for Boiler Furnaces. Engineering, vol. 114, no. 2949, July 7, 1922, pp. 24-27, 10 figs. Description of apparatus built by Ljüngstrom Steam Turbine Co.

FURNACES, METALLURGICAL

Aluminum-Melting. Aluminum and Aluminum-Alloy Melting Furnaces, Robt. J. Anderson. Can. Foundryman, vol. 13, no. 7, July 1922, pp. 19-23, 3 figs. Review of work undertaken by U.S. Bur. Mines to decrease metal and fuel losses in melting.

G

GALVANIZING

Weight of Coating. Determination of Spelter Coating on Sheets, D. M. Strickland. Raw Material, vol. 5, no. 6, July 1922, pp. 227-228, 1 fig. Simple and accurate method which may be applied to all shapes and sizes of specimens. Portable equipment for field tests. Paper read at annual mtg. Am. Soc. for Testing Mtls.

GAS BURNERS

Efficiency. Effect of B.t.u. on Burner Efficiency, Berry, Brumbaugh, Eiseman, Moulton and Shawn. Gas Age-Rec., vol. 50, no. 2, July 8, 1922, pp. 41-44 and 46-48, 16 figs. Investigation made by Public Service Commission of Maryland to determine most economic and satisfactory heating value standard for Baltimore. Laboratory tests made by Bur. of Standards in this connection to determine relative efficiency of gases of different heating value and adaptability of existing appliances for gases differing in heating value and composition. Advance publication of paper to be made Technologic Paper of Bur. of Standards.

GAS ENGINES

Blast-Furnace Gas. The Nurnberg Gas Engine (Die Nürnberger Gasmaschine), J. Schmidt. Elektrotechnischer Anzeiger, vol. 39, nos. 72, 73 and 74. May 6, 9 and 10, 1922, pp. 601-602, 613-614 and 619-620, 5 figs. Describes 4-stroke, two-cylinder tandem engine, 700 hp. at 125 r.p.m. (normal size 2,000 hp.), for more economic utilization of blast-furnace gas; consumes 2200 to 2400 German heat units per b.hp.-hr., at full load; application of tandem gas engines for driving dynamos.

GAS HOLDERS

Waterless. A Waterless Gasholder, Ed. Bonnet. Gas Jl., vol. 159, no. 3090, Aug. 2, 1922, pp. 268-269, 3 figs. Details of "dry" holders made by Augsburg-Nuremburg Machine Factory (Man.) Germany. Advantages; results of tests. Translated from paper read before Société Technique de l'Industrie du Gaz en France.

GAS INDUSTRY

Canada. The Gas Industry in Canada. Gas Jl., vol. 159, no. 3087, July 12, 1922, pp. 92-93, 1 fig. Statistics of gas consumption and description of vertical retort installations at Vancouver and Victoria.

GAS PRODUCERS

Ash-Fusion. Ash Fusion Gas Producer, M. A. Fichet. Am. Gas Jl., vol. 116, no. 24, June 17, 1922. pp. 550-552, 2 figs. Producer resembling small blast furnace in which complete combustion is attained by burning coal to fusion of ash. From Journal des Usines à Gaz, 1922, pp. 1-7.

Electric. Gasification of Fuels by Means of the Electric Current (Vergasung von Brennstoffen mit Hilfe des elektrischen Stromes), Gwosdz. Wärme, vol. 45, no. 20, May 19, 1922, pp. 247-250, 1 fig. Application of electric current to gas producers; describes Stassano, Girod, Holengren, and other types of apparatus.

GASES

Hydraulic Compression. Production of Pure Gases by the Principle of Hydraulic Compression (Gewinnung reiner Gase unter Anwendung des hydraulischen Kompressionprinzips), C. Heirich. Zeit. für komprimierte u. flüssige Gase, vol. 22, nos. 1, 2 and 3, 1922, pp. 3-7, 21-22 and 43-44, 1 fig. Principles and operation of hydrocompressor; gives cost data of a plant; use of hydraulic compressors in Linde liquefaction and rectification process for production of liquid or gaseous oxygen.

GEAR CUTTING

BEVEL. Cutting Bevel Gears, Franklin D. Jones. Machy. (N.Y.), vol. 28, no. 12, Aug. 1922, pp. 968-971, 7 figs. Principal adjustments required in setting up Gleason bevel-gear generators and time required for cutting gears of different sizes and pitches.

HIGH-SPEED. Producing Gears in Quantity at High Speed, J. H. Rodgers. Can. Machy., vol. 28, no. 1, July 6, 1922, pp. 33-35, 4 figs. Modern gear cutters very efficient; multiple fixtures reduce non-productive time; automatic operation practically eliminates possiblity of error; special method for bevel gears.

GEARS

GEAR-TOOTH COMPARATOR. A New Instrument for Checking Gear Tooth Profiles and Spacing. Automotive Industries, vol. 47, no. 4, July 27, 1922, p. 171, 3 figs. Describes Odontometer for comparing uniformity or determining interchangeability of gears. Applicable to gears of any pressure angle; can be applied while gear is still in machine.

GIRDERS

CALCULATION. Calculation of Girders on Two-Supports Partly Fitted (Calcul général des pièces à deux appuis à encastrement partiel), Louis Gellusseau. Génie Civil, vol. 80, nos. 14, 15, 16, 17, 18, 24 and 25, Apr. 8, 15, 22, 29, May 6, June 17 and 24, 1922, pp. 315-318, 335-339, 359-361, 375-378, 401,403, 546-548, and 564-567, 32 figs. Discusses reinforced-concrete construction; detailed definition of "encastrement"; develops formulas and makes calculations for string boards, rectangular frames, circular and parabolic arches, girders with constant and variable cross-sections, etc.

GRINDING

BEARINGS. Grinding in the Automotive Industry. Machy. (N.Y.), vol. 28, no. 12, Aug. 1922, pp. 946-951, 11 figs. Methods of grinding steel balls and ball bearing races; grinding roller bearing cups, cones and rollers.

H

HARDNESS

TESTING. Hardness Testing Methods (Sur les Méthodes d'essai de dureté des corps), Georges Moreau. Revue Générale de l'Electricité, vol. 12, no. 3, July 22, 1922, pp. 106-111, 3 figs. Describes new method of testing materials, being improvement on Brinell method, i.e., dynamic hardness which is defined as relation between pressure exerted by ball during penetration on surface of impression.

The Testing of Metals for Hardness, S. P. Rockwell. Am. Soc. for Steel Treating Trans., vol. 2, no. 11, Aug. 1922, pp. 1013-1033, 27 figs. Results of tests made on standard Brinell, scleroscope and Rockwell hardness-testing machines.

HEAT STORAGE

APPARATUS. Heat Storage Apparatus, C. Boileau. Elec. Times, vol. 62, no. 1603, July 6, 1922, pp. 7-9. Raising of central-station load factors by electric heat storage. From L'Electricien.

HEAT TRANSMISSION

NON-CONDUCTING MATERIALS. The Transmission of Heat Through and the Efficiency of Non-Conducting Materials, Masao Kinoshita. Domestic Eng. (English), vol. 42, no. 42, June 1922, pp. 116-120, 5 figs. Mathematical consideration (1) in which distribution of temperature in system of bodies considered remains unchanged, (2) in which temperature distribution changes from time to time.

REFRACTORY MATERIALS. The Thermal Conductivity of Refractory Materials at High Temperatures, A. T. Green. Gas World, vol. 77, no. 1908, July 1, 1922, pp. 13-18, 2 figs. Review of previous work; Fourier's linear-diffusion equation; measurement of rate of rise of temperature for isothermal plane at known distance from hot face; texture; porosity; results. Paper read before Instn. Gas Engrs.

HIGHWAYS

MOTOR TRUCK REGULATION. Motor Truck Regulations to Reduce Highway Wear and Tear, C. W. Cornell. Contract Rec., vol. 36, no. 27, July 5, 1922, pp. 667-669. Maximum loads and speeds need to be defined if impact effects are to be minimized; danger of overloading and overspeeding.

PENNSYLVANIA STATE ORGANIZATION. Pennsylvania State Highway Organization. Pub. Works, vol. 53, no. 1, July 1, 1922, pp. 1-5, 3 figs. Rational classification of responsibilities and operation by interlocking system of executive management construction and maintenance division, supplemented by township and automobile division and auditing and accounting departments, totaling more than 500 staff employees required in 1921 for expenditure of $43,000,000.

HYDRAULIC TURBINES

QUEENSTON-CHIPPAWA PLANT. 55,000-Hp. Turbines for the Queenston Power Station, Ontario. Engineering, vol. 114, no. 2950, July 14, 1922, pp. 31-35, 19 figs. Description of turbines of Queenston-Chippawa development with illustration.

HYDROELECTRIC DEVELOPMENTS

CANADIAN PROGRESS. Hydro-Electric Progress in Canada. Universal Engr., vol. 35, no. 6, June 1922, pp. 24-27. Brief review of development work in individual provinces and of progress in investigation and plans.

INDIA. The Hydro-Electric Survey of India, J. W. Meares. Beama, vol. 10, no. 6, June 1922, pp. 409-411. 350,000 hp. developed or under construction; 1½ million hp. investigated by Survey; 1½ million in known sites not yet investigated; probably 4 to 10 million more.

QUEENSTON-CHIPPAWA, CANADA. Queenston-Chippawa Developments of the Hydro-Electric Power Commission of Ontario, F. A. Gaby. Am. Int. Elec. Engrs. Jl., vol. 41, no. 7, July 1922, pp. 508-526, 29 figs. General description of entire development on Canadian side of Niagara River which will have ultimate capacity of approximately 650,000 hp.

TUGALO RIVER. Water Power Development on the Tugalo River. Eng. World, vol. 21, no. 1, July 1922, pp. 7-8, 5 figs. Georgia Ry. and Power Co. 50,000-Kw. development costing $1,600,000 to be finished next year.

HYDROELECTRIC PLANTS

FRANCE. Hydroelectric Plant at Mouthier L'Usine génératrice hydroélectrique de la Loue à Monthier), J. Reyval. Revue Générale de l'Electricité, vol. 11, no. 19, May 19, 1922, pp. 691-714, 21 figs. Describes generating station at Mouthier on the Loue; total power 16,000 hp.; generating equipment; overhead lines; transformers; stations, etc.

Hydroelectric Plant of the Paul Girod Steel Works at Ugines, Savoie (Les Usines hydro-électriques de la Compagnie des Forges et Aciéries électriques Paul Girod à Ugines (Savoie)], V. Sylvestre. Houille Blanche, vol. 21, nos. 65-66, May-June 1922, pp. 73-83, 10 figs. Describes civil-engineering work in connection with construction of dams and reservoirs; pressure piping; Pelton wheels; etc.

GERMANY. Concrete and Reinforced-Concrete Works at the Isar (Beton- und Eisenbetonarbeiten an der Mittleren Isar), Hans Stanglmayr. Bauingenieur, vol. 3, no. 11, June 15, 1922, pp. 334-342, 9 figs. Reviews number of hydroelectric power works on the river vicinity of Munich, and gives details of construction work.

New Hydroelectric Plants in Bavaria and Thuringia (Neuere Wasserkraftanlagen in Bayern und Thuringen). Schwenk. Bauingenieur, vol. 3, nos. 8, 9, 10 and 11, Apr. 30, May 15, 31 and June 15, 1922, pp. 230-234, 267-273, 300-307 and 330-334, 40 figs. Apr. 30: Civil engineering features of Wisenttal power plant and electric equipment, including Francis double-spiral turbines by Escher, Wyss & Co., and d.c. generators by Siemens-Schuckert. May 15: Describes power plant at Ziegenrück, on river Saale, its constructional features and equipment. May 31: Describes power plant at Hausen; hydraulic features, turbine equipment, etc. June 15: Describes power plant No. 2 at Munich, South, and its equipment, including two units of two coupled Francis turbines each, having head of 4.4 m., 1760 hp. at 125 r.p.m., and 80 per cent efficiency.

ITALY. Hydroelectric Plant of the Barbellino (L'impianto idroelettrico del Barbellino), F. Zanon. Industria, vol. 36, no. 11, June 15, 1922, pp. 201-208, 9 figs. Hydraulic construction work; dams and reservoirs of the lakes of Barbellino, Malgina and Valmorta; power piping; list of central stations drawing their water power from these lakes.

SWEDEN. Haugesund Electric Power Station (Haugesundhalvöens og Karmöys elektrisitetsforsyningsanlaeg), O. Aas-Jörgensen. Teknisk Ukeblad, vol. 69, no. 27, July 7, 1922, pp. 252-255, 9 figs. Construction work and equipment of this high tension station with 60,000 volts capacity.

SWITZERLAND. An Extra-High Head Hydro-Electric Plant. Engineer, vol. 134, no. 3474, July 28, 1922, pp. 88-90, 9 figs. Description of Fully plant in Switzerland, operating under head of 1600.7 m., or 5416 ft.

I

ICE MANUFACTURE

CLEAR ICE. Making of Clear Ice, John E. Starr. Refrig. World, vol. 57, no. 7, July 1922, pp. 11-12 and 14. Increase to ice-making capacity and cold-storage space obtained by remodeling and modernizing plant and equipment.

IGNITION

ANGLE OF CYLINDER AXES. Angle of Cylinder Axes for Uniform Ignition (Gabelwinkel für gleichmässige Zündfolge bei mehrreiheigen Verkehrsmotoren), H. Schrön. Motorwagen, vol. 25, nos. 16 and 17, June 10 and 20, 1922, pp. 307-312 and 329-333, 107 figs. Describes angle of cylinder axes in connection with crankshaft arrangements for multiple-cylinder motors. Concludes that construction with cylinders opposite each other leaves free choice of angle but complicates crankshaft; normal construction simplifies crankshaft.

HIGH-TENSION SPARK. High Tension Spark-Ignition in Internal-Combustion Engines, J. D. Morgan. Instn. Mech. Engrs. Proc., no. 2, 1922, pp. 303-315, 6 figs. What is expected of spark-generators and discussion of spark and conditions effecting its production.

IMPACT TESTING

ALLOY STEELS. Significance of the Impact Test, F. C. Langenberg and N. Richardson. Forging and Heat Treating, vol. 8, no. 7, July 1922, pp. 309-312. Typical test data on certain alloy steels and ordnances steels are recorded, illustrating author's conclusions and furnishing opportunity for comparison of static and dynamic tests. Paper from Symposium before Am. Soc. for Testing Matls.

INDUSTRIAL MANAGEMENT

FORD'S FOUR PRODUCTION PRINCIPLES. Ford's Four Production Principles, Samuel Crowther. Factory, vol. 29, no. 1, July 1922, pp. 15-17. Never letting well enough alone; always apportioning responsibility definitely; holding foremen not for costs but for production; treating interest charges as decreased profit.

STABILIZING PROFITS BY CHARTS. Charting as an Aid in Stabilizing Profits, Percy A. Bivins. Indus. Management, vol. 63, nos. 5 and 6, and vol. 64, no. 1, May, June and July 1922, pp. 257-265, 355-361 and 33-42, 29 figs. Enabling executives to apply graphic methods to problem of profit stabilization.

See also time study.

INSPECTION

See optical instruments.

INSTRUMENTS

SCIENTIFIC, MECHANICAL DESIGN. The Mechanical Design of Scientific Instruments. Engineering vol. 113, nos. 2945, 2946, 2947 and 2948, June 9, 16, 23 and 30, 1922, pp. 729-730, 763-764, 794, and 828-829, 24 figs. Consideration in design of qualitative and quantitative instruments used in many branches of physical engineering and chemical sciences. Abstract of three Cantor Lectures delivered before Royal Soc. of Arts.

INSULATING MATERIALS

RESEARCH METHODS. Directions for the Study of Hard Composite Dielectrics (Insulating Materials), Instn. Elec. Engrs. Jl., vol. 60, no. 309, May 1922, pp. 565-574, 19 figs. Methods of test for use in investigation of mechanical and electrical properties, and suitability for different classes of service. Report from British Elec. and Allied Industries Research Assn.

INSULATORS, ELECTRIC

OVERPOTENTIAL TESTS. An Overpotential Test for Insulators, G. W. Lapp. Am. Inst. Elec. Engrs. Jl. vol. 41, no. 7, July 1922, pp. 491-495, 5 figs. Endeavour to establish by specific test that each insulator has liberal initial factor of safety and will be proof against deterioration is cause of test described.

INTERNAL-COMBUSTION ENGINES

Maximum Pressures. Comparing Maximum Pressures in Internal Combustion Engines, Stanwood W. Sparrow and Stephen M. Lee. Nat. Advisory Committee for Aeronautics Tech. Notes no. 101, June 1922, 4 pp., 3 figs. Thin metal diaphragms form satisfactory means; diaphragm is clamped between two washers in spark-plug shell and its thickness is chosen such that when subjected to explosion pressure exposed portion will be sheared from rim in short time.

See also automobile engines; diesel engines; gas engines; ignition; oil engines; semi diesel engines;

IRON

Puddled. Make Puddled Iron Mechanically, E. C. Kreutzberg. Iron Trade Rev., vol. 71, no. 6, Aug. 10, 1922, pp. 365-366, 9 figs. Description of puddler developed at Eastern plant producing 1500-lb. puddle balls at rate of one per hr.

IRON AND STEEL

Fiber in. Fibre in Iron and Steel, F. F. McIntosh. Am. Soc. for Steel Treating, Trans., vol. 2, no. 10, July 1922, pp. 856-863 and (discussion) 864-868, 9 figs. Importance of fibre in performance of iron or steel and factors which govern formation and character.

IRON CASTINGS

Manufacture Direct from Ore. Making High-Grade Castings Direct from the Ore, F. H. Bell. Can. Foundryman, vol. 13, no. 7, July 1922, pp. 17-18, 2 figs. Ore melted in ordinary blast furnace is kept in vacuum thermos container until chemical analysis is taken after which it is mixed with cupola iron.

Rolls. Casting Rolls (Walzenguss), Carl Irresberger. Giesserei Zeitung, vol. 19, nos. 23, 24, 25 and 26, June 6, 13, 20 and 27, 1922, pp. 342-345, 354-358, 371-374 and 381-386, 55 figs. Processes of casting steel rolls; tempered and untempered cast-iron rolls; molds; annealing furnaces; hardening and depth of penetration; hollow rolls.

IRRIGATION

Canals, Graphical Determination. Dimensions of Irrigation Canals Graphically Determined, P. Baumann. Can. Engr., vol. 43, no. 2, July 11, 1922, pp. 137-138, 2 figs. Value of graphical methods for practical proportioning; slope and required discharge being known, area, depth of water required and velocity readily found.

Efficiency. The Efficiency of Irrigation, G.E. P. Smith. Contract Rec., vol. 36, no. 28, July 12, 1922, pp. 697-699. Water losses and ways of reducing them; distribution; duty of water.

Return-Flow. Return-Flow Water from Irrigation Developments, R. I. Meeker. Eng. News-Rec., vol. 89, no. 3, July 20, 1922, pp. 105-108. Discussion of return seepage water from irrigation to water diverted; statistics of Colorado Valleys indicate one acre-foot per acre recoverable, maximum in summer and fall.

J

JAPANNING

Methods. Japanning, S. R. Gerber. Metal Industry (N.Y.), vol. 20, nos. 6 and 7, June and July 1922, pp. 225-227 and 161-163, 5 figs. Description of methods by which rule-of-thumb operations of an old art were changed to standard operations.

K

KEROSENE

Vegetable and Animal Oils as Sources. Catalytic Transformation of Vegetable and Animal Oils Into Kerosene (Transformation catalytique des huiles végétales et animales en pétrole), Alphonse Mailhe. Annales de Chimie, vol. 17, May-June 1922, pp. 304-332. Concludes that it is easy to reduce hydrocarbons from animal and vegetable oils, and that resulting hydrocarbons are in nature of mixed kerosenes very much like Borneo kerosene which has similar composition.

L

LABOUR

Craftsmen Councils. Brief History of Craftsmen Movement in Cleveland. Universal Engr., vol. 36, no. 2, Aug. 1922, pp. 42, 44 and 46, 1 fig. Organization of craftsmen councils by groups of masons engaged in same line of industry.

LABORATORIES

[illegible]. Technical [illegible] of the Postal Telegraph Office (Le [illegible] télégraphes), Jacques Boyer. Nature, no. 2512, May 27, 1922, pp. 325-330, 8 figs. Describes Paris official laboratory in which telegraph, telephone and other instruments of the service are tested.

[illegible] Laboratory (Un laboratoire d'essais à 500,000 volts), H. de Raemy. Revue Générale de l'Electricité, vol. 11, no. [illegible], 1922, pp. [illegible] new laboratory of Ateliers de Constructions électriques de Delle, at Villeurbanne, which is especially [illegible] for transmission lines.

LADLES

Stopper. Development in Design of Casting Ladle Bungs. Metal Industry (Lond.), vol. 20, no. 26, June 30, 1922, pp. 621-622, 6 figs. Discussion of design which should make connection between bung rod and bung absolutely certain and easy to make. From Stahl u. Eisen.

LIGHTING

Glareless. Light Without Glare, Ward Harrison. Am. Inst. Elec. Engrs. Jl., vol. 41, no. 8, Aug. 1922, pp. 609-615, 8 figs. Discussion of features determining satisfactory illumination without glare. Includes tables from Illumination Eng. Soc. Code of Indus. Lighting in which for first time light sources are modified.

Industrial. Good Lighting an Essential in the Efficient Conduct of Business, J. H. O'Hara. Elec. News, vol. 31, no. 13, July 1, 1922, pp. 36-39. Expenditure of one-half of one per cent of pay roll increases output five per cent. Saving equal to ten times expense. Practical example. Paper read before C.E.A. convention.

Office Buildings. Indirect Lighting in City Office Building, G. F. Evans & J. W. Morrison. Elec. World, vol. 80, no. 2, July 8, 1922, pp. 61-62, 6 figs. Dixie terminal building in Cincinnati uses system with 8 to 15 foot-candles; arcade illumination eliminates hanging fixtures; aids to maintenance included in design.

Safety. Illumination and the Worker, G. Bertram. Regar. Safety, vol. 9, no. 7, July 1922, pp. 156-160, 4 figs. Value of correct use in making for safe conditions in industry.

LIGHTNING ARRESTERS

Types. Lightning Arresters, H. Cotton. Beama, vol. 10, nos. 5, 6 and 7, May, June and July 1922, pp. 358-364, 418-426 and 497-504, 28 figs. Lightning phenomena and the different ways in which overvoltages are produced; earthing choking coil; condensers; water jet, horn gap, electrolytic, and oxide film arresters; protection of telephone circuits.

LIGNITE

Carbonization. Modern Methods of Treating Lignite and Its Derivatives (Procédés modernes pour le traitement du lignite et de ses dérivés). Chaleur et Industrie, vol. 3, no. 25, May 1922, pp. 1274-1276, 2 figs. Discusses carbonization; Fischer rotary furnace.

LIME

Plants. New Lime Plant is Last Word in Modern Efficiency, William B. Eastwood. Cement, Mill and Quarry, vol. 21, no. 2, July 20, 1922, pp. 35-41 and 44, 14 figs. Mining, crushing, screening, calcining, hydrating and shipping are continuous without waste or climatic interruption.

LIQUIDS

Inflammable, Storage of. Storing Inflammable Liquids (Lagerung feuergefährlicher Flüssigkeiten). Zeit. des Bayerischen Revisions-Vereins, vol. 26, no. 12, June 30, 1922, pp. 100-102, 1 fig. Bavarian safety regulations for storage of petroleum, benzene, gasoline, etc., especially use of protective gas.

LOCOMOTIVE BOILERS

Circulation Effect on Efficiency. Effect of Circulation on Locomotive Boiler Efficiency, F. G. Lister. Steam, vol. 30, no. 1, July 1922, pp. 7-10. Recent attempts to create more rapid and unrestricted circulation thereby attaining more nearly uniform temperature throughout and reducing equal expansion and contraction of all parts. Paper read before Int. Ry. Fuel Assn.

LOCOMOTIVES

Design and Construction. Report on Locomotive Construction. Ry. Age, (Daily), vol. 72, no. 24d, June 21, 1922, pp. 1631-1639. Various developments of year and résumé of 11 reports including recommendations (A.R.A. Mech. Div. Proc.).

Drifting Valves. When a Locomotive Drifts. Ry. Jl., vol. 28, no. 8, Aug. 1922, pp. 21-22, 3 figs. Description of Ripken automatic drifting valve.

Electric. *See Electric Locomotive.*

Failure Causes and Remedies. Why Engines Fail, Frank C. Packard. Central Ry. Club Proc., vol. 30, no. 3, May 1922, pp. 1187-1198 and (discussion) 1198-1217. Analysis of failure and causes; losses caused thereby and argument for placing of full responsibility.

Fuel Consumption. Effect of Tonnage and Speed on Fuel Consumption, J. E. Davenport. Ry. Age, vol. 73, no. 2, July 8, 1922, pp. 71-75, 8 figs. Ten miles per hr. affects fuel rate; economical tonnage for various speeds, effect of grade and car weight. (Abstract). Paper read before Int. Ry. Fuel Assn.

Increasing Mileage of. Increasing Locomotive Mileage — A Chemical Problem First, W. H. Hobbs. Ry. Rev., vol. 71, no. 1, July 1, 1922, pp. 11-12. Why better boiler feedwater is essential to increase in productive time of locomotive.

Mountain Type. A Mountain Type Locomotive for High Capacity. Ry. Mech. Engr., vol. 96, no. 7, July 1922, pp. 381-385, 11 figs. New Union Pacific locomotive is lightest per unit of power of any 4-8-2-yet built, weighing 345,000 lb. and having maximum tractive effort of 54,800 lb. ***See also Ry. Rev., vol. 70, no. 23, June 10, 1922, pp. 816 826, 16 figs, partly on supp. plate.***

Oil-Burning. Oil Fuel for Locomotives on the Taltal Railway of Chile, E. H. Revill. Ry. Gaz., vol. 36, no. 26, June 30, 1922, pp. 1030-1034, 6 figs. Comparison of oil and coal as fuel; economies which have been effected by use of oil; design of oil-fuel apparatus burners.

Operation. Work of the Commission for the Utilization of Fuel — 6th Report (Travaux de la Commission d'Utilisation du Combustible — Sixième Rapport). Bul. de la Société d'Encouragement pour l'industrie Nationale, vol. 134, no. 6, June 1922, pp. 565-599. Report of First Sub-Committee. Efficiency of locomotives; steam consumption and distribution; feedwater preheating; operation of locomotives.

Steam-Turbine. The Ljungström Turbine Locomotive (Ljungströms turbinlokomotiv), Fredrik Ljungstrom. Teknisk Tidskrift, vol. 52, nos. 21, 22, 23, and 25, May 27, June 3, 10 and 23, 1922, pp. 331-333, 348-351, 363-367 and 396-400, 31 figs. Experimental work, and construction and operation of locomotives driven by steam turbines. Particulars of saving resulting.

Turbo-Condensing Turbo-Condensing Locomotive Development in Europe. Ry. Rev., vol. 71, no. 7, Aug. 12, 1922, pp. 201-207, 9 figs. Details of Ljungstrom turbine-condensing locomotive placed in service on Swedish State Railways.

LUBRICATING OILS

Analysis. Technical Examination of Lubricating Oil and Grease, F. W. Watson and H. D. Bell. Chem., Met. and Min. Soc. of So. Africa Jl., vol. 22, no. 11, pp. 211-219. Analytical methods and data. Results of tests.

Coolers for. Tubular Oil Cooler. Engineering vol. 114, no. 2951, July 21, 1922, p. 89, 6 figs. Describes marine cooler having 250 ft. cooling space, and which will deal with $1\frac{1}{2}$ million B.t.u. per hr. Constructed by Serck Radiators, Ltd.

LUBRICATION

Mechanism of. The Mechanism of Lubrication, Robt. E. Wilson and D. P. Barnard, 4th. Soc. Automotive Engrs., Jl., vol. 11, no. 1, July 1922, pp. 49-60, 11 figs. Presenting best available data to afford basis for predicting effect of different variables under any specified conditions.

Oil Drops. What Determines the Size of the Oil Drop, W. F. Osborne. Power, vol. 56, no. 7, Aug. 15, 1922, pp. 251-252. Discussion of conditions affecting size of oil drops going to engine cylinder.

M

MACHINE TOOLS

Gear Drive. Methods of Machine Tool Design, A. L. De Leeuw. Am. Mach., vol. 57, no. 6, Aug. 10, 1922, pp. 223-227, 12 figs. Comparative merits of cone and tumbler quick gear change device.

MACHINING

Deformation During. Avoiding Deformation During Machining, A. Whitehead. Engineer, vol. 134, no. 3474, July 28, 1922, pp. 98-99, 3 figs. Discusses as example, chucking of a ball race, machining small piston, and holding small armature.

MAGNESIUM ALLOYS

Engineering Uses. Magnesium Alloys in Engineering. Practical Engr., vol. 65, no. 1844, June 29, 1922, pp. 404-405, 2 figs. Electron containing 80 per cent magnesium for automobile pistons; general physical characteristics and precautions in molding.

MALLEABLE IRON

Drilling Data. Malleable-Iron Drilling Data, H. A. Schwartz and W. W. Flagle. Soc. Automotive Engrs. Jl., vol. 11, no. 1, July 1922, pp. 81-87, 12 figs. Drill tests of five factors that influence machining properties of malleable iron.

MATERIALS

Testing. Testing Materials for Shipbuilding, Leon Guillet. Engineering, vol. 114, no. 2950, July 14, 1922, pp. 57-58, 6 figs. Methods of testing. Tensile, falling weight, ball hardness, punching, wearing, alternating, and physical tests, and macrographic investigations.

MEASURING INSTRUMENTS

End Measurement. Accurate End Measurement on Measuring Machines Using a Screw, H. Baker. Engineer, vol. 134, no. 3474, July 28, 1922, pp. 81-83, 6 figs. Experiments relating to attempts to measure correctly to one ten-thousandth of a millimeter. Description of machine used and methods.

Hollow Membrane. Measuring and Regulating by Means of A Hollow Membrane (Messen und Regeln mit Hilfe der Hohlmembran), E. Stach. Glückauf, vol. 58, no. 26, July 1, 1922, pp. 807-813, 10 figs. Requirements of measuring and recording instruments as to construction and sensitiveness; shows that hollow metals membrane recorder gives better results than wet measuring instruments.

METAL SPRAYING

Metals for. Metals and Alloys Suitable for Spraying (Für Spritzguss geeignete Metalle und Legierungen), F. Reinboth. Metall-Technik, vol. 48, no. 24, June 8, 1922, pp. 266-267. Composition of various alloys and their choice for a given purpose which requires given physical or electrical properties.

Schoop Process. The Schoop Metal Spraying Process With Special Reference to Its Application in Shipbuilding (Das Schoopsche Metallspritzverfahren), M. U. Schoop. Schiffbau, vol. 23, no. 38, June 21, 1922, pp. 1106-1107, 1 fig. Various uses of metallizing pistol for covering chains, anchors, etc., with zinc, ship bottoms and propellers with copper, etc.

METALS

Electroanalysis of Alloys. Electro-Analysis of Metals and Alloys, Kling and Lassieur. Chem. Trade Jl. and Chem. Engr., vol. 71, no. 1835, July 21, 1922, pp. 73-74. Description of new rapid method of electrolytic analysis applicable to wide range of metals. Translated from Annales de Chimie Analytique, June 15, 1922.

Hardening. On the Theory of the Hardening of Metals, Kotaro Honda. Science Reports Tôhoku Imperial Univ., 1st series, vol. 11, no. 1, Apr. 1922, pp. 19-28. Martensite being homogeneous solid solution, is hard principally because of nature of atomic forces; consideration of hardness due to crystalline structure of metals.

Spinning. Metal Spinning and Spinning Tools, Edward Heller. Machy. (N.Y.), vol. 28, no. 12, Aug. 1922, pp. 972-976, 9 figs. Description of machinery and methods for various types of spinning.

MILLING MACHINES

Aligning and Inspecting. Aligning and Inspecting Milling Machines. Machy. Lond., vol 20, no. 511, July 13, 1922, pp. 441-444, 6 figs. Methods employed by manufacturers of Cleveland milling machine.

MINERAL RESOURCES

Lead-Zinc near Great Slave Lake. Lead-Zinc deposits Near Great Slave Lake, Northwest Territory, C. B. Dawson. Can. Min. Jl., vol. 43, no. 23, June 9, 1922, p. 358. Investigations have shown rich prospects when improvements in transportation have been accomplished.

MINERALS

Barytes. Marketing of Barytes, S. W. Thompson. Eng. and Min. Jl., Press, vol. 114, no. 3, July 15, 1922, pp. 109-110. Mining of mineral has increased greatly during last 5 years; Georgia and Missouri are principal domestic sources; manufacture of lithopone, an "Infant Industry" takes half output; used in rubber and paint.

MOLDING MACHINES

Types. Molding Machines (La staffatura a scosse ed alcuni tipi staffatrici), P. A. Sordelli. Industria, vol. 36, no. 11, June 15, 1922, pp. 211-214, 9 figs. Describes various types of molding machines with pneumatic stripping arrangement, including that of Britannia Foundry, Coventry, and that of Leber & Bröse, and their operation.

MONEL METAL

Tubular Uses. Monel Metal's Merits in Tubular Uses, J. L. Sussman. Raw Material, vol. 5, no. 6, July 1922, pp. 208-210, 6 figs. Manufacture in tube form is step toward solving problem of chemically resistant non-fragile material.

MORTARS

Lime. Hardening of Hydraulic Binders — Quality and Acceptance of Lime (Le durcissement des liants hydrauliques. Qualités et réception des chaux), E. Camerman. Annales de l'Association des Ingénieurs Sortis des Ecoles Spéciales de Gand, vol. 12, no. 1, 1922, pp. 1-15, 1 fig. Discusses in detail question of colloidal solutions; silicate and its part in hardening of hydraulic binders hydraulic lime; tensile strength; specifications.

MOTOR BUSES

Design and Operation. Principles of Motor Bus Design and Operation, David Beecroft. Commercial Vehicle, vol. 26, no. 11, July 1, 1922, pp. 12-14, 3 figs. Principles that apply to big Fifth Avenue buses apply also to all buses everywhere; why design is big factor in successful bus operation. Review of paper presented by Col. Green at Semi- Annual mtg. of S.A.E.

Developments. Characteristics of Present-Day Buses, R. E. Plimpton. Bus Transportation, vol. 1, no. 7, July 1922, pp. 375-378, 3 figs. Requirements for city, inter-city, and country service considered; comfort and convenience factors found in modern bodies; devices for fare collection now being installed. (Abstract.) Paper read before Soc. Automotive Engrs.

MOTOR TRUCKS

Steam. A Steam Six-Wheeler, Motor Transport, vol. 34, no. 904, June 26, 1922, p. 781, 3 figs. Two-wheeled conversion attachment to Ransomes steam wagon which affords enormous carrying capacity.

A Milestone in Steam Design. Motor Transport, vol. 34, no. 904, June 26, 1922, pp. 768-771, 8 figs. New 7-ton Yorkshire employing steam power in conjunction with many of best features of petrol car practice.

Tipping Gears. Tipping Gears for Motor Lorry Bodies, W. Erskine Dommett. Eng. Rev., vol. 35, no. 12, June 1922, pp. 406-412, 15 figs. Manner in which mechanical and hydraulic types have accomplished speed of operation, angle of tilt, ease when manually actuated. lightness, reliability, and low cost.

N

NITRIC ACID

Manufacture, Saltpeter vs. Synthetic Ammonia. Nitric Acid from Saltpeter or Synthetic Ammonia, Guy B. Taylor. Chem. Age (N.Y.), vol. 30, no. 6, June 1922, pp. 244-246, 1 fig. Cost factors and conditions that will determine raw material of nitric acid manufacture.

NITROGEN

Fixation. The Fixed Nitrogen Research Laboratory. Chem. Age (N.Y.), vol. 30, no. 6, June 1922, pp. 266-267, 4 figs. Equipment and facilities of plant at American University, Wash. D.C., and government work carried on there.

Synthetic, Products. Synthetic Nitrogen Products and the Ammonia Obtained as By-Product in Coal Distillation (Les produits azotés synthétiques, et l'ammoniaque obtenus comme sous-produits de distillation de la houille), A. Grebel. Génie Civil, vol. 80, no. 25, June 24, 1922, pp. 567-570. Influence of different phases of recovery and treatment of ammonia on final yield of sulphate.

NON-FERROUS METALS

Gas Absorption and Oxidation. Gas Absorption and Oxidation, B. Woyski and John W. Boeck. Foundry, vol. 50, no. 14, July 15, 1922, pp. 571-573, 2 figs. Defects in non ferrous metals caused by gas absorption often erroneously attributed to oxidation; defective metal brought back to normal by proper melting practice; oxides of low gravity remain in metal. Paper read before Am. Inst. Min. and Met. Engrs.

NUMBERS

DUO-DECIMAL SYSTEM. Standardization of Numbers (Die Normung des Zahlenmasses), Alfred Sieber. Maschinenbau, vol 1, no 5, June 10, 1922, pp. 280-284, 4 figs. Disadvantages of decimal system and advantages of duo-decimal system.

O

OIL

BRIQUETTING. Solid Oil With Peat Vehicle, Wm. A. Hall. Petroleum Times, vol. 8, no 184, July 15, 1922, p 90. Brief description of method of producing solid oil with peat as vehicle.
DIELECTRIC STRENGTH. Three Thousand Tests on the Dielectric Strength of Oil, J. L. R. Hayden and W. N. Eddy. Am. Inst. Elec. Engrs. Jl. vol. 41, no. 7, July 1922, pp. 495-499, 7 figs. Three groups with standard insulating oil and small sphere, large sphere, and sphere-needle gap; one with commercial, another with chemically pure benzol, and last with air.
PROTECTION FROM EVAPORATION. Durable Foam Seal Stops Evaporation and Reduces Fire Risk. Paul Truesdell. Nat. Petroleum News, vol. 14, no. 28, July 12, 1922, pp. 43-44, 1 fig. Sealite, compound containing 50 per cent air, cornstarch, glycerine and gelatine and other ingredients, when poured over top of tank of oil, spreads over surface forming floating seal which prevents evaporation and fire.

OILS

ROAD. Road Oils and Their Properties as Demonstrated by Current Tests, C. M. Baskin. Can. Engr., vol. 43, no. 6, Aug. 8, 1922, pp. 238-241, 2 figs. Data of tests to establish value of oils for road oiling purposes.

OIL ENGINES

DESIGN. The Oil Engine of To-day, Chas. E. Lucke. Power, vol. 56, no. 7, Aug. 15, 1922, pp. 241-243, 2 figs. Discussion of recent improvements in general design that have made oil engine thoroughly reliable, including fuel charging and cylinder cooling.
HEAVY-OIL. Present State of Heavy-Oil Engines (Etat actuel de la Question des Moteurs à Huile Lourde.) Marcel Bochet. Mémoires et Compte Rendu des Travaux de la Société des Ingénieurs Civils de France, vol. 75, nos 1-3, Jan.-Mar. 1922, pp. 87-105, 15 figs. partly on supp. plates. Discusses marine engines used in various shipyards; describes semi-Diesel engine and its operation.
OPERATION. Oil Engine Hints, Bert Bare. Power Plant Eng., vol. 26, no. 14, July 15, 1922, pp. 704-707, 2 figs. Hot ignition; missing; hunting; failure to start; loss of compression; compression card.

OIL FUELS

VEGETABLE. Using Vegetable Oils for Fuels (Utilisation des huiles végétales comme combustibles industriels), Maurice Leduc. Chaleur et Industrie, vol. 3, no. 25, May 1922, pp. 1277-1280. Their calorific power; French vegetable oils; unlimited production; use in oil-burning installations.

OIL SHALES

VALUE OF. Factors Influencing the Value of Oil-Shale Lands, Dean E. Winchester. Eng. and Min. Jl. Press, vol. 114, no. 2, July 8, 1922, pp. 61-66, 3 figs. Careful analysis of factors other than recoverable oil which affect value of a deposit.

OFFICE MANAGEMENT

STAFF TRAINING. Scientific Organization of Work at the Factory (Contribution au problème de l'organisation scientifique du travail dans les ateliers), Gaston Vidal. Arts et Métiers, vol. 75, no. 20, May 1922, pp. 129-141, 12 figs. Activities of National Schools of Arts et Métiers in training office workers.

OPTICAL INSTRUMENTS

SCREW AND GEAR INSPECTION. Inspection by Optical Projection. Machy. (N.Y.), vol 28, no 12, Aug. 1922, pp 984-988, 6 figs. Description of Methods with particular data on screw and gear inspection.

P

PAINTS

PHYSICAL PROPERTIES. Some Physical Properties of Paints. P. H. Walker and J. G. Thompson. Ry. Rev., vol. 71, no. 3, July 15, 1922, pp. 76-81, 2 figs. Investigations by U.S. Bur. Standards presented at convention of Am. Soc. for Testing Matl.
SULPHATE PULP LINED DIGESTERS. Sulphate Pulp Made in Lined Digesters, P. C. Austin. Paper, vol 30, no 16, June 21, 1922, pp 11 and 16. Prevention of leaks, improved yield and steam economy among advantages. Paper read before joint convention of Cost Assn of Paper Industry and Am. Pulp and Paper Mill Superintendent's Assn.

PAPER MANUFACTURE

STARCH, USE OF. The Use of Starch in Paper Manufacture, W. A. Nivling. Paper Mill, vol. 46, no. 26, July 8, 1922, pp. 4-6 and 8, 11 figs. Consideration of [illegible] differences in sizing operation. Paper read at Superintendents' [illegible].

PAVEMENTS

COSTS. Effect of Initial [illegible] Ultimate Costs, W. R. Rosengarten. Highway Engr. and Contractor, vol. 7, no. 1, July 1922, pp. 39-42, 5 figs. [illegible] asphalt in building modern highways.

WHEEL LOAD DISTRIBUTION. Distribution of Wheel Load on Pavement Sections, H. F. Clemmer and C. A. Hogentogler. Eng. and Contracting, vol. 58, no. 1, July 5, 1922, pp. 5-9, 4 figs. Results of research investigation at Bates experimental road and general deductions therefrom.

PAVEMENTS, ASPHALTIC CONCRETE

ADVANTAGES. Development of Asphaltic Concrete, R. G. Davidson. Contract Rec. vol 36, no. 26, June 28, 1922, pp. 608-612. Merits of this type of pavement; evolution of bituminous road and improvements in methods of construction.

PAVEMENTS, CONCRETE

CONSTRUCTION IN HOT WEATHER. Concrete Pavement Construction in Hot Weather. Contract Rec., vol. 36, no. 29, July 19, 1922, pp. 708-710, 3 figs. Measures to be taken to ensure satisfactory results in summer season; protection against evaporation of necessary moisture is chief essential.

PEAT

BOILER FIRING. Experience With Peat Firing of Steam Boilers (Erfahrungen über die Verheizung von Torf im Dampfkesselbetriebe), Ph. Stauf. Zeit. des Bayerischeff Revisions-Vereins, vol. 26, no. 13, July 15, 1922, pp. 103-106, 4 figs. Composition and calorific value of peat; suitability of furnaces for peat; comparative figures as to cost.

PILE DRIVERS

HAMMER BLOW. The Efficiency of the Hammer Blow, and Its Effects with Reference to Piling, A. Hiley. Engineering, vol. 113, nos. 2944, 2945 and 2946, June 2, and 16, 1922, pp. 673-674, 711-714, and 745-746, 8 figs. June 2: Scientific means of determining specifications for pile drivers. June 9: Determination of losses of efficiency and means of reducing them. June 16: Considerations governing efficiency when using extractor hammers.

PIPE, CAST-IRON

ANALYSIS AND SELECTION. Getting Best Results with Cast Iron Pipe, F. A. McInnis. Fire and Water Engr., vol. 72, no. 5, Aug. 2, 1922, pp. 221-222. Practical suggestion as to selection of pipe including analyses as to sulphur content made in Boston and elsewhere.

PIPE, CONCRETE

CULVERT. How the Burlington Builds Concrete Culvert Pipe. Ry. Maintenance Engr., vol. 18, no. 7, July 1922, pp. 230-234, 9 figs. Operations involved; steel and wood forms; making of cages; handwork on reinforcement; improved loading methods.

PIPE LINES

DESIGN. Pipe Line (Rohrleitungen), M. Fränkl. Maschinenbau, vol. 1, no. 6, June 24, 1922, pp. 343-346, 5 figs. Essential points in pipe-line installations; most economic kind of pipe; most suitable design of a given installation.

PIPE, WOOD

NOTES ON. Some Observations Concerning Wood Pipe, J. W. Ledoux. Am. Water Works Assn. Jl., vol. 9, no. 4, July 1922, pp. 549-569. Cost design in particular; formula for strength; water hammer; discharging capacity; comparison of wooden and cast-iron pipes.

POLES, WOODEN

PRESERVATIVE TREATMENT. Adds Life to Southern Pine, P. R. Hicks. Telephone Engr., vol. 26, no. 7, July 1922, pp. 16-19, 3 figs. Pressure creosoted southern pine poles good for many years of thrifty service says noted expert on pole preservation; tells processes and records.

PORCELAIN

TENSILE STRENGTH. The Tensile Strength of Porcelain, F. H. Riddle and J. S. Laird. Am. Ceramic Soc. Jl., vol. 5, no. 7, July 1922, pp. 385-393, 6 figs. Method of accurate determination; ratio of tensile to compression strength; judging of quality.

POWER FACTOR

CENTRAL STATION. Power-Factor Problem of the Central Station, C. W. Drake. Elec. Jl., vol. 19, no. 7, July 1922, pp. 284-289, 5 figs. Induction motor characteristics; overmotoring; possible improvement in power factor of squirrel cage motors; apparatus which will supply necessary reactive kva.; comparative costs of various methods.

POWER PLANTS

BIRMINGHAM, NECHELLS STATION. Electricity Supply in Birmingham. Electrician, vol. 88, no. 2301, June 23, 1922, pp. 744-750, 7 figs. Details of 105,000-kw. ultimate capacity station started before war and now reaching completion.
DEVELOPMENT. Notes from Report of Prime Movers Committee of N.E.L.A. Power Plant Eng., vol. 26, no. 14, July 15, 1922, pp. 697-703, 9 figs. Résumé of development in power-plant engineering during past year.
STEAM CONDITIONS. The Choice of Steam Conditions in Modern Power Stations, L. C. Kemp. Electrician, vol. 88, no. 2302, June 30, 1922, pp. 774-777, 4 figs. Investigation indicating that more careful selection of steam conditions should be encouraged.

POWER TRANSMISSION

Radiotelegraphic. The Problem of Radiotelegraphic Power Transmission (Étude sur le problème de la télémécanique par T. S. F.), Maurice Guéritot. Onde Electrique, vol. 1, no. 3, Mar. 1922, pp. 141-151, 3 figs. Reviews work done in transmitting power by radio to perform certain work at a distance, especially French investigations during war, and discusses difficulties of control at a distance.

PRECIPITATION

Electrical. Electrical Engineering Features of the Electrical Precipitation Process, G. H. Horne, Am. Inst. Elec. Engrs. Jl. vol. 41, no. 7, July 1922, pp. 552-558, 11 figs. Development of transformers, source of power, methods of rectification, relation between precipitation and impressed voltage; power consumption.

Electrical. Recent Conclusions Pertaining to Electrical Precipitation, Walter A. Schmidt. Am. Inst. Elec. Engrs. Jl., vol. 41, no. 7, July 1922, pp. 547-552, 6 figs. Presenting comprehensive conclusions from Investigations of recent years. Bibliography.

PULVERIZED COAL

Explosion Hazard. Pulverized Coal Is Dangerous on the Surface as Well as Underground; Precautions to be Taken in Handling It, L. D. Tracy. Coal Age, vol. 22, no. 5, Aug. 3, 1922, pp. 161-168, 5 figs. Precautions to prevent explosion, particularly with reference to driers and electrical devices; data on self-ignition. From paper read before Fire Chief's Club of Ohio.

Feeding. Principles of Feeding Pulverized Fuel, M. W. Arrowood. Combustion, vol. 7, no. 1, July 1922, pp. 31-34, 47, 6 figs. Consideration of proper method of injection to obtain best conditions at various points in furnace.

R

RADIO COMMUNICATION

Waves, Direction and Intensity of European. The Direction and Intensity of Waves from European Stations, Greenleaf W. Pickard. Inst. Radio Engrs. Proc. vol. 10, no. 3, June 1922, pp. 161-174, 7 figs. Deviation of radio goniometric readings from true bearing of distance and nearby stations measured with coil antenna and receiver. Intensity measured by resistance network. Bibliography.

RADIO TELEGRAPHY

Developments. Radio Telegraphy, Guglielmo Marconi. Am. Inst. Elec. Engrs. Jl., vol. 41, no. 8, Aug. 1922, pp. 561-570, 12 figs. Discussion of recent developments including phenomenal static and travel of electric waves. Also observation of short electric waves under 20 meters with particular reference to unidirectional transmission.

Transmitter Performance. Performance of a Radio-Telegraphic Transmitter with Special Reference to New Installation at North Foreland, Norman Lea. Wireless World, vol. 10, no. 13, June 24, 1922, pp. 384-388, 10 figs. Description of instrument; determination of losses including those in motor alternator, transformer, low-frequency choke, condenser, main spark gap, aerial, etc.

RADIOTELEPHONY

Loud-Speaking Apparatus. Talking to Thousands by Telephone. Telephony, vol. 83, no. 1, July 1, 1922, pp. 21-23, 8 figs. Description of equipment by which officials in New York and San Francisco talked to 25,000 employees of West. Elec. Co. at Hawthorne, Chicago, Ill.

RAILS

Bull-Head. Specification for Bull-Head Rails. Iron and Coal Trades Rev., vol. 105, no. 2836, July 7, 1922, p. 5. Specifications issued by British Eng. Standards Assn.

Wear. The Wavy Wear of Rails (Usure ondulatoire des Rails), M. E. Resal. Industrie des Tramways, Chemins de fer et Transports Publics Automobiles, vol. 16, no. 181, Jan. 1922, pp. 10-17, 13 figs. Discusses question in connection with rolling of metal which may be responsible for wave formation, and advises experiments to be made, especially to prove connection.

RAILWAY ELECTRIFICATION

France. Electrification in France, M. Sabouret, Elec. Ry. and Tramway Jl., vol. 46, nos. 1130 and 1136, May 12 and June 16, 1922, pp. 212-214 and 278-280, 5 figs. Report of chief engr. of Orleans Ry. Co. to Internat. Ry. Congress at Rome showing plans for 5000 miles to be electrified.

Main-Line Railroads. Electrification of Main Line Railroads, S. T. Dodd. Gen. Elec. Rev., vol. 25, no. 7, July 1922, pp. 439-440. Outstanding features of accomplished and contemplated installations.

Trend of Development. The Electrification of Railways, F. Rowlinson. Beama, vol. 10, nos. 5 and 6, May and June 1922, pp. 349-357 and 437-444, 12 figs. Outstanding features of successful installation and facts to be considered in prospective ones.

RAILWAY OPERATION

Service of Supply. The Origin and Development of the Service of Supply, George G. Yeomans. Ry. Rev., vol. 70, nos. 23 and 24, vol. 71, no. 1, June 10, 17 and July 1, 1922, pp. 868-869, 923-927 and 12-15. Short history of most recent fundamental development in railway organization.

Train Control. British Approve Automatic Train Control. Ry. Age, vol. 73, no. 4, July 22, 1922, pp. 149-153, 2 figs. Ministry of Transport Committee recommends intermittent contact type; disapproves of speed control.

RAILWAY REPAIR SHOPS

Santa Fe Ry. Santa Fe Competes Modern Shops at Albuquerque. Ry. Age, vol. 73, no. 6, Aug. 5, 1922, pp. 237-242, 10 figs. Description of locomotive repair building.

RAILWAY SHOPS

Canadian Pacific at Angus. How Shop Output is increased and Costs Reduced at Angus. Ry. Rev., vol. 70, no. 23, June 10, 1922, pp. 854-865, 19 figs. Organization and equipment and expression of value of effective shop scheduling system.

Car. Equipment and Operation of a Modern Steel Car Plant, Geo. A. Richardson. Ry. Rev., vol. 70, no. 24, June 17, 1922, pp. 913-918, 8 figs. Plant of Cambria Steel Co., Johnstown, Pa., which is integral part of steel manufacturing organization; capable of building 50 all-steel cars a day.

RAILWAY SIGNALING

Locomotive Cab Signals. On the Question of Locomotive Cab Signals, Faustino Villa. Int. Ry. Assn. Bul., vol. 4, no. 5-6, May-June 1922, pp. 821-862, 17 figs. Classification and functions; mechanical, electrical and electro-mechanical repeating apparatus.

RAILWAY SWITCHES

Remote Operation. Remote Operation of Switches on the New Haven. Ry. Age, vol. 73, no. 6, Aug. 5, 1922, pp. 251-252, 6 figs. Satisfactory results are reported after 40 years experience with 28 low-voltage machines.

RAILWAY TERMINALS

Operation. Terminal Stations for Passengers, L. Maccallini. Int. Ry. Assn. Bul., vol. 4, nos 5-6, May-June 1922, pp. 753-761. Best arrangements to reduce number of movements of engines and empty cars.

RAILWAY TIES

Reinforced-Concrete. Note on Some Recent Types of Reinforced Concrete Sleepers, R. Desprets. Int. Ry. Assn. Bul., vol. 4, no. 7, July 1922, pp. 950-971, 6 figs. Investigation of Calot type tried by Paris-Orleans Ry. Co. and Vagneux type tried by Paris-Lyons-Mediterranean Ry. Co. Latter is less expensive.

RAILWAY TRACK

Effect of Rolling Stock on. Action and Reaction Between Rolling Stock and Track (Considérations générales sur les actions réciproques de la voie et du matériel roulant et sur le calcul des rails), R. Desprets. Annales des Travaux Publics de Belgique, vol. 13, no. 2, Apr. 1922, pp. 233-272, 6 figs. Analyzes forces and stresses, vertical, longitudinal and lateral action, and makes calculations of rails on this basis.

REAMERS

Standardization. Standardizing Shell Reamers and Arbors, H. S. Kartsher. Machy (N.Y.), vol. 28, no. 11, July 1922, pp. 892-895, 7 figs. Standard dimensions governing fits, and gages used for inspection.

REFRACTORIES

Fireclay. Fireclay Refractories; C. E. Bales. Nat. Engr., vol. 26, no. 7, July 1922, pp. 300-303, 3 figs. Origin and occurrence of fireclay; mining and preparation for use; relation to boiler practice. Paper read before Kentucky No. 1, N.A.S.E.

Research. Report of the Refractory Materials Research Committee. Gas Jl., vol. 158, no. 3085, June 28, 1922, pp. 840-851 and (discussion) 851-852, 4 figs. Revision of British specification. Standardization of After-Contraction Test, by D. A. Jones. Thermal Conductivity of Refractory Materials at High Temperatures, by A. T. Green.

REFRIGERATING MACHINES

Turbo-Compressor. A New Refrigerating Machine. Ice and Refrigeration, vol. 63, no. 1, July 1922, pp. 43-45, 2 figs. Novel turbo-compressor newly discovered low-pressure refrigerating fluid demonstrated before gathering of 300 engineers at plant of Carrier Engr. Corp., Newark, N.J.; machines especially adapted for producing cold water required in cooling air for industrial purposes.

RELAYS

Overload. Overload Inverse-Time-Limit Relay With A Definite Adjustable Minimum. Elec. Rev., vol. 90, no. 2, 324, June 9, 1922, pp. 825-826. Description of instrument which has inverse-time-limit characteristics up to certain current value, but for higher current values up to short circuit conditions, fixed time limit.

Protective. Trend in Relay Protection. Elec. World, vol. 80, no. 2, July 8, 1922, pp. 66-68, 2 figs. Protective devices committee of A.I.E.E. finds that differential schemes are becoming most popular. All classes may be grouped under four divisions; great diversity in practice found.

RIVETING

Hammers for. Operations with Riveting Hammers. Machy. (Lond.), vol. 20, no. 511, July 13, 1922, pp. 453-455, 6 figs. Examples of cold-heading and rivet-setting operations performed on high-speed riveting hammers.

ROAD MATERIALS

Field Tests. Field Testing of Materials in Highway Construction, John H. Bateman, Eng. and Contracting, vol. 58, no. 1, July 5, 1922, p. 10. Sand tests: determination of organic matter in sand; tests of water for concrete; concrete consistency determination. (Abstract) Paper read before conference on Highway Engineering at Univ. of Mich.

ROADS

Bates Experimental. Bates Experimental Road Tests. Highway Engr. and Contractor, vol. 7, no. 1, July 1922, pp. 27-35, 26 figs. Reports of Progress made in Illinois in testing to destruction various types of pavements.

SURFACES. Design of Rigid Type Road Surfaces. A. T. Goldbeck. Can Engr., vol 43, no 6, Aug 8, 1922, pp. 227-230, 5 figs. Effect of moisture content of subgrade; stresses produced by warping of road slab; temperature and shrinkage effects; reinforcement against longitudinal cracking; sometimes better to use longitudinal joint.

ROADS, MACADAM

RESURFACING WITH TAR MACADAM. Machine Built Tar Penetration Macadam Roads of St. Louis County, Missouri. Georges H. Martin. Eng. and Contracting, vol 58, no 1, July 5, 1922, pp 19-20, 2 figs. Repairing of roads tributary to St. Louis by applying material on top of old roads.

ROLLING MILLS

REVERSING PASSES. Layout and Arrangement of Reversing Passes in Rolling Mills (Unterwerke für Umkehrwalzenstrassen), H. Baclesse. Elektrotechnische Rundschau, vol. 39, no. 1, Jan. 31, 1922, pp. 1-5, 9 figs. Electric equipment and its advantageous location and arrangement.

S

SCAFFOLDS

SUSPENDED. Suspended Scaffolds for Building Construction. Contractors' and Engrs.' Monthly, vol. 4, no. 6, June 1922, pp. 45-46, 2 figs. Description of "Little Wonder" suspended scaffold, which is claimed to reduce possibilities of accidents.

SEMI-DIESEL ENGINES

CONSTRUCTION AND APPLICATION. The Semi-Diesel Engine, Its Construction and Application (Les moteurs semi-Diesel, état actuel de leur construction et de leur utilisation), Adrien Schubert. Bul. de la Société d'Encouragement pour l'Industrie Nationale, vol. 134, no. 5, May 1922, pp. 418-505, 78 figs. Indicator diagrams; efficiency; fuel injection; water injection; ignition; starting; fuels, including vegetable oils; present types. Bibliography.

SEMI-STEEL

PROPERTIES AND USE. Semi-Steel, J. Cameron. Metal Industry (Lond.), vol. 30, no. 26, June 30, 1922, pp. 623-629, 6 figs. Definition, field for use, tests and raw materials for production, heat treatment. Paper read before Instn. British Foundrymen. See also Foundry Trade Jl., vol. 25, no. 305, June 29, 1922, pp. 495-500, 6 figs.

SEWAGE DISPOSAL

ACTIVATED SLUDGE. Operation and Dewatering at Largest Activated-Sludge Plants at Houston, Texas Eng. News-Rec., vol. 69, no. 4, July 27, 1922, pp. 132-137, 4 figs. Ten and five in. g.d. sewage works. Description operating curves and cost for 1920 and 1921; acid conditioning tests.

SEWERS

DESIGN. Sewers (Egouts Publics), Ch. Dubosch. Annales des Travaux Publics de Belgique, vol. 22, nos. 2, 3, 4 and 5, Apr. June, Aug. and Oct. 1921, pp. 259-305, 411-444, 627-666 and 831-865, 70 figs. partly on supp. plates. Apr.: Reviews history of sewer construction; collection and removal of sewage; flowi n sewers; outfalls. June: Layout and leveling of sewer systems; rainfall and surface water collection; pumps; Aug. and Oct.: Cross sections of channels, their construction.

SHELLAC

ORIGIN, UTILIZATION AND EXAMINATION. Shellac, Its Origin, Utilization and Examination (Der Schellack, seine Entstehung, Verarbeitung und Untersuchung), Hans Wolff. Chemiker-Zeitung, vol. 46, nos. 35 and 38, Mar. 23 and 30, 1922, pp. 265-266 and 291-293, 2 figs. Mar. 23: Production: types on market; bleaching and solubility. Mar. 30: Chemical composition; properties; uses.

SHIPS, CONCRETE

AMERICAN DIESEL-ENGINED. Concrete Construction by the U.S. War Department. Motorship, vol. 7, no. 8, Aug. 1922, pp. 613-618, 12 figs. Description of some America built concrete Diesel-powered ships, 43 in number.

MOTORSHIPS. U. S. War Department's Concrete Motorship Fleet. Motorship, vol. 7, no. 7, July 1922, p. 515, 1 fig. First details of 7 successful Winton Diesel-Engined twin-screw passenger and cargo vessels.

SILVER METALLURGY

ROASTING, MECHANICAL. Evolution of Mechanical Roasting in Silver-Lead Smelting, Leonard S. Austin. Min. and Metallurgy, no 188, Aug 1922, pp 27-29. Recovery of old speiss bottoms; uses of Brown-O'Hara furnace; sinter speeds up blast furnace work.

SMOKE ABATEMENT

PARIS. The Smoke Question in Industrial Centers (La Question des fumées dans les agglomérations industrielles). Journal des Usines à Gaz, vol. 46, no 11, June 5, 1922, pp 161-167, 2 figs. Gives text of Paris police regulations to prevent smoking and progress in their application.

SOLDERS

ALUMINUM. Tests of Aluminum Solders, Automotive Industries, vol. 47, no. 4, July 27, 1922, p. 168. Data on tests on soldered joints made at McCook [illegible]

METALLURGICAL INVESTIGATION. A Metallurgical Investigation of Solders, Wallace Dent Williams. Raw Material, vol. 5, no. 6, July 1922, pp. 216-223, 6 figs. Fusibility; scratch hardness; low melting point for white metals; silver solders; autogeneous soldering; borax substitutes.

SPRINGS

HELICAL. A Coiling and Heat Treating Plant for Helical Springs, William J. Merten. Am. Soc. for Steel Treating Trans., vol. 2, no. 11, Aug. 1922, pp. 977-983, 5 figs. Main features of plant for insuring maximum economy of labor and materials consistent with securing high-grade product.

STACKS

KILN, DESIGN OF. Stability and Design of a Kiln Stack, T. W. Garve. Am. Ceramic Soc. Jl., vol. 5, no. 7, July 1922, pp. 455-467, 9 figs. Advantages of stack draft compared with fan draft and calculations for stability; practical requirements in stack building.

STEAM ACCUMULATORS

RUTHS. Steam Accumulators (Dampfspeicher), Johannes Ruths. Zeit. des Vereines deutscher Ingenieure, vol. 66, nos. 21, 22 and 24, May 27, June 3 and 17, 1922, pp. 509-513, 537-542 and 597-605, 62 figs. May 27: Construction and applicaton of Ruths accumulator; possibility of equalizing pressures with various boiler types; plants already built; use of these accumulators in new constructions or extensions of present plants. June 3: Cooling losses; water level indicators; superheat accumulators. June 17: Existing installations of steam accumulators for equalizing variations in steam for boiling and heating, and for equalizing power and steam variations.

STEAM ENGINES

FLYWHEEL, DEGREE OF IRREGULARITY. Graphical Determination of the Degree of irregularity of an Engine (Calcul graphique du degré d'irrégularité d'une machine), G. Laville. Revue Générale de l'Electricité, vol. 12, no. 3, July 22, 1922, pp. 85-91, 10 figs. Method for determining moment of inertia of flywheel of machines as function of degree of irregularity.

STEAM METERS

CHEMICAL MEASUREMENT. Measuring Steam by Chemical Means (Het meten van stoom langs chemischen weg), J. Rutten. Chemisch Weekblach, vol. 19, no. 21, May 27, 1922, pp. 229-232, 1 fig. Chemical method for measuring steam at factories where steam is largely used in various departments, which gives much more exact results than ordinary metering systems.

STEAM TURBINES

DESIGN. Modern Steam Turbines (Les Turbines à vapeur modernes), Alb. Schlag. Revue Universelle des Mines, vol. 13, nos. 2, 3, 4 and 5, Apr. 15, May 1, 15 and June 1, 1922, pp. 95-100, 189-198, 265-272 and 351-358, 15 figs. Apr. 15: Actual state of steam-turbine industry; reaction and impulse types. May 1: Principal factors influencing construction of large turbines; security of operation; efficiency; dimensions; weight and cost, etc. May 15: Power of turbines at a given speed; accidents with large turbines; lubrication.

DISKS, CALCULATION OF. Contribution to the Exact Calculation of Steam Turbine Disks with Variable Thickness (Beitrag zur genaren Berechnung der Dampfturbinenscheibenräder mit veränderlicher Dicke), Alexander Fischer. Zeit. des Oesterr. Ingenieur- u. Architekten Vereites, vol. 74, nos. 9-10 and 15-16, Mar. 3 and Apr. 14, 1922, pp. 46-49 and 71-73, 2 figs. Presents solution of the Stodola differential equation of radial displacement of rotating disks.

REFRIGERATING PLANTS. Steam Turbine in the Refrigerating Plant, W. F. Schaphorst. Refrigeration, vol. 30, no. 2, Apr. 1922, pp. 27-28 and 42-44. Sixteen advantages over other type of prime movers.

STEEL

ALLOY. *See alloy steel.*

BALL. Ball Steel, Hilton G. Freeland. Am. Soc. for Steel Treating Trans., vol. 2, no. 10, July 1922, pp. 898-911 and (discussion) 911-917, 5 figs. Ball manufacturer's problems arising from quality of steel received, and effect on final product.

CEMENTITE SPHEROIDIZING. Spheroidizing of Cementite in Steel, H. C. Ibsen. Forging and Heat Treating, vol. 8, no. 7, July 1922, pp. 300-303, 9 figs. Results of tests on 1 per cent carbon steel show that long-time anneal is not necessary to obtain spheroidized structure; such steel reveals increased ductility and shock-resisting value.

CHROMIUM. *See chromium steel.*

CRYSTALLIZATION, DELAYED. On Delayed Crystallization in the Carbon Steels: The Formation of Pearlite, Troostite and Martensite, A. F. Hallimond. Engineering, vol. 113, no. 2946, June 16, 1922, pp. 767-769, 1 fig. Development of principles which explain delayed critical points and corresponding structure in terms of supersaturation theory. Paper read before Iron and Steel Inst.

ROCK-DRILL. Breakage and Heat Treatment of Rock Drill Steel. Eng. World, vol. 21, no. 1, July 1922, pp. 39-40. Progress report to members of Advisory Board to Bur. of Mines and Bur. of Standards.

RUSTLESS. Investigation of Rustless Steels (Några undersökningar på rostfritt stål), Bengt Kjerrman. Jernkontorets Annaler, vol. 107, no. 4, 1922, pp. 133-149, 7 figs. Development of rust and acid-resisting steels, their thermic-microscopic examination.

TOOL. *See tool steel.*

STEEL, HEAT TREATMENT OF

ELECTRIC-FURNACE. The Electric Furnace as it affects Over-All Cost of Heat Treated Parts, C. L. Ipsen. Am. Soc. for Steel Treating Trans., vol. 2, no. 11, Aug. 1922, pp. 984-989, 9 figs. Points out advantages and economy of electric furnaces.

HIGH-SPEED STEEL. The Toughness of High Speed Steels as Affected by Their Treatment, Marcus A. Grossman. Am. Soc. for Steel Treating Trans., vol. 2, no. 11, Aug. 1922, pp. 1001-1005, 5 figs. Results of measurements on high-speed steels of 18 per cent and 13 per cent tungsten type, hardened at temperatures ranging from 1700 deg. to 2250 deg. Fahr.

STEEL MANUFACTURE

Direct Method. A Direct Method of Steel Manufacture. Metal Industry Lond.) vol 21, no 1, July 7, 1922, pp 9 and 11-12, 3 figs Discussion of Bourcoud process and possibility of using oil, lignites and other fuels, data on costs

STEEL WORKS

Power Systems. Power Systems and the Steel Industry, E. C Stone Iron and Steel Elec. Engrs Assn , vol 4, no 6, June 1922, pp 279-301 and discussion 302-320, 4 figs. Requirements for thoroughly reliable source of power supply, and consideration.

STOKERS

Underfeed, Low-Grade Fuel. The Underfeed Stoker Successfully Burns Low-Grade Fuel. Elec. Ry. Jl., vol. 60, no. 7, Aug. 12, 1922, pp. 221-225, 9-figs. High-ash, clinkering coal burned in specially designed underfeed stokers; operation features by flexibility, high efficiency, capacities up to 350 per cent.

STORAGE BATTERIES

Charging, Balancer Set For Balancer Set for Battery Charging, H M Phillips. Power Plant Eng., vol. 26, no. 13, July 1, 1922, pp. 657-659, 4 figs. Connections, characteristics, and calculation of current, voltage and power requirements.

STREAM POLUTION

Problem. Some Phases of the streams Pollution Problem, J. K. Hoskins. Am. Water Works Assn., vol. 9, no. 4, July 1922, pp. 570-581, 1 fig. General discussion with particular reference to maker of pollution and methods of determination.

STRESSES

Influence Lines. Influence Lines and Their Application (Les lignes d'influence et leur application), Guillemin. Revue Universelle des Mines, vol. 13, nos. 5 and 6, June 1 and 15, 1922, pp. 329-350 and 531-429, 19 figs. Stresses in framework; hyperstatic construction; influence lines of stresses; determination of maximum flexure in section of a beam under direct load supported at each end; influence lines in latticed beams and arches.

Optical Determination. The determination of Poisson's Ratio and of the absolute Stress-variation of Refractive Index, F. Twyman and J. W. Perry. Physical Soc. of Lond. Proc., vol. 34, Part 4, June 15, 1922, pp. 151-154, 3 figs. Ready method of determining stress-optical coefficients by Hilger interferometer. Simultaneous determination of Young's modulus and Poisson's ratio.

Recorder, Iron And Steel. When Steel Beams Stretch, P. J. Risdon. Sci. Am., July 1922, p. 32, 2 figs. Fereday-Palmer stress recorder which automatically magnifies stretch or compression of steel work in a given length and records corresponding stress per sq. in.

SUBSTATIONS

Automatic. How Resistance Is Used in Railway Automatic Substations, C. A. Butcher. Elec. Ry. Jl. ,vol. 60, no. 7, Aug. 12, 1922, pp. 227-230. Analysis of conditions which affect selections of details of equipment for automatic control of substations

Hydroelectric. Enlarging the Brantford Hydro Station. Elec. News. vol. 31, no. 13, July 1, 1922, pp. 42-44, 5 figs. Some unique features in installation where maximum capacity in minimum space was main problem.

Railway. Noiseless Substation for Los Angeles Railway, George E. Campbell. Elec. Ry. Jl., vol. 60, no. 2, July 8, 1922, pp. 37-38, 4 fig. By means of circuitous route for sound-laden air designers were able to muffle noise from machinery; building is of massive design and harmonizes architecturally with neighborhood.

SUPERHEATED STEAM

Power Plants. Superheated Steam a Factor in Power Plant Economy, R. A. Holme. Eng. World, vol. 21 no. 1, July 1922, pp. 35-38, 1fig. Capacity and efficiency of equipment increased at moderate cost by installation of superheaters; savings in connection with all types of prime movers; advanced practice at Hell Gate.

SURVEYING

Triangulation. The Value of Geodetic Control in City Survey Work, Hugh C. Mitchell. Eng. News-Rec., vol. 89, no. 3, July 20, 1922, pp. 101-103. One triangulation should serve exacting demands; accuracy and permanence invaluable; survey standards that should be maintened.

SWITCHGEAR

Design And Manufacture. Recent Tendencies in Switchgear Design and Manufacture, J. R. Cowie. Electrician vol. 88, no. 2302, June 30, 1922, pp. 778-782, 4 figs. Outstanding features of armour clad and cell-structure types.

T

TANKS

Calibration. A Rapid and Accurate Method for the Calculation of Storage Tanks, J. W. McDavid. Chem. & Met. Eng., vol. 27, no. 4, July 26, 1922,pp. 157-158, 1 fig. Description of apparatus for calibration of tanks.

TELEPHONY

Automatic. Relay Automatic Telephone Company's System at Fleetwood Exchange, A. B. Eason. Post Office Elec. Engrs. Jl., vol. 15, no. 2, July 1922. pp. 112-133, 13 figs. Description of principles of Relay Automatic System, and equipment installed for ultimate capacity of 920 lines.

Loud-speaker Apparatus Loud Speaking Telephone Apparatus. Telegraph and Telephone Age, vol 940 no 14, July 16, 1922, pp 321-322 Description of apparatus for making voice audible to large audience and data of electric energy required under various conditions.

TESTING MACHINES

Metals, Toughness And Hardness. Toughness in Relation to Hardness of Metals, E. F Lake Forging & Heat Treating, vol. 8, no. 7, July 1922, pp 313-315, 5 figs Discusses importance of testing machine which will show "tough-hardness" or wearing qualities by means of quickly performed test; importance of related data.

THERMIT WELDING

Process Thermit Welding, J H Deppeler Am. Welding Soc Jl., vol. 1, no. 6 June 1922, pp. 33-36. Value of this type in all heavy operations.

TIDAL POWER

Utilization. Utilization of Tidal Power (Note sur l'utilisation des Marées), G. Boisnier. Houille Blanche, vol. 21, nos. 63-64 and 65-66, Mar.-Apr. and May-June 1922, pp. 45-50 and 86-88, 5 figs. Means of recovering power of tides and the various systems that have been proposed.

TOLERANCES

Screw Threads. Screw Tolerances (Gewindetoleranzen), G. Berndt. Werkstatts Technik, vol. 16, no. 12, June 15, 1922, pp. 349-356. A compilation of material from all countries on tolerances for bolts, nuts, etc.

TOOL STEEL

Standardization. Tool Steel—Shall it be Standardized?, Roy H. Davies. Raw Material, vol. 5, no. 6, July 1922, pp. 233-235. Arguments pro and con substitution of analyses for tool steel brands. Presented at Convention of Nat. Assn. Purchasing Agents.

TOOLS

Press. Press Tool Operation in the Manufacture of Buckle Fittings, Albert Hind. Machy. (Lond.), vol. 20, no. 511, July 13, 1922, pp. 449-452, 4 figs. Details and operation of press tools for manufacture of metal brace or buckle fittings.

Straight-Form, Calculation. The Calculation of Straight-form Tools having Top Machy. (Lond.), vol. 20, no. 510, July 6, 1922, pp. 416-418, 4 figs. Method of using data given in Machinery's Handbook for figuring top rake on tools which are to cut through and hard materials.

TRANSFORMERS

Oil Tests. Tests for Transformer Oils, E. T. Delbridge. Oil News, vol. 10, no. 13, July 5, 1922, pp. 35-36. Yearly consumption of transformer oil valued at $2,000,000; functions of transformer oil; durability and stability important qualities; durability tests.

Testing for. A 350,000-Volt Testing Transformer (Transformateur d'essais à 350,000 volts), R. Massot and P. Bunet. Revue Générale de l'Electricité, vol. 11, no. 20, May 20, 1922, pp. 752-757, 5 figs. Describes apparatus built by Ateliers de Constructions électriques de Lyon et du Dauphine, and discusses its operation at their laboratory.

TUNNELLING

Hetch Hetchy Aqueduct. Driving an Eighteen-Mile Tunnel Through the Sierra Nevada, Arthur B. Parsons. Eng. and Min. Jl., Press., vol. 114, no. 3, July 15, 1922, pp. 96-108, 15 figs., partly on supp. plates. Details of methods used in operations on mountain division of Hetch Hetchy aqueduct that is to supply San Francisco with water; organization of work; record established for rapid progress; costs.

Shield Method. Driving a Concrete-Block Sewer Tunnel by Shield; some Troubles and Their Remedies. Eng. News-Rec., vol. 89, no. 5, August 3, 1922,pp. 174-176, 4 figs. Record of experience in water-bearing sand at Flushing; traveling platform for supporting leading ring; new equipment sets blocks accurately to place in first operation.

TUNNELS

Conversion to Open Cut. Eliminating a Tunnel Without Interrupting Traffic Eng. News-Rec., vol. 89, no. 5, Aug. 3, 1922, pp. 182-185, 6 figs Bessemer and Lake Erie R.R. convert tunnel into deep open cut and builds bridge over first lift of cut; no work trains on main tracks.

TURBO-COMPRESSORS

High-Speed Airplane. Turbo-Compressors for High-Speed Aviation, A. Rateau. Engineering, vol. 114, nos. 2951 and 2952, July 21 and 28, 1922, pp. 91-94 and 123-125, 9 figs. Discussion of design; specific pressures and weights of air under normal atmospheric conditions. Paper read before Instn. Mech. Engrs.

TURBO-GENERATORS

Oscillations Calculation. Calculation of Oscillations in Turbo-Generators (Berechnung der Schwingungserscheinungen an Turbodynamos), Jos. Geiger. Zeit. des Vereines deutscher Ingenieure, vol. 66, no. 26, July 1, 1922, pp. 667-669, 6 figs. Simple methods for precalculation of vibrations of foundations of turbo-generators.

V

VACUUM TUBES

Triode Valves. On the Electro-magnetic Screening of a Triode Oscillator, R. L. Smith-Rose. Physical Soc. of Long. Proc., vol. 34, part 4, June 15, 1922, pp. 127-138, 5 figs. Enclosing valve set in metal box of suitable thickness for frequency used and hermetically sealing all joints. More convenient arrangement for use of continuous-wave wireless direction finding.

VISCOSITY

Determination. Viscosity Determination by Means of Orifices and Tubes. W. N. Bond. Physical Soc. of Lond. Proc., vol. 34, Part 4, June 15, 1922, pp. 139-144, 1 fig. Investigation of corrections applicable to determination of viscosity due to abnormal flow at ends of tubes. Expression for end-corrections.

Determination in CO_2, N_2O, CO and N_2. Viscous Properties of CO_2, N_2O, CO and N_2, C. J. Smith. Physical Soc. of Lond. Proc., vol. 34, Part 4, June 15, 1922, pp. 155-165, 2 figs. Direct comparisons by observing time required by mercury pellet across equal volumes of gas through capillary tube. Mean area of collision deduced from Chapman's formula.

VOLTAGES

Standardization. Standardization of Voltages in Transmission Lines and A.C. Three-Phase Distribution (Remarques sur la normalisation des tensions électriques des réseaux de transmission et de distribution d'énergie par courant alternatif triphasé), Ch. Lavenchy. Revue Générale de l'Electricité, vol. 11, no. 25, June 24, 1922, pp. 926-928, 1 fig. Discusses geometric and arithmetic progressions in voltages and gives tabulation of number of series of values in use.

W

WATER GAS

Research. Seventh Report of the Research Sub-Committee of the Gas Investigation Committee of the Institution of Gas Engineers. Gas Jl., vol. 158, no. 3085, June 28, pp. 800-825 and (discussion) 825-827, 10 figs. Investigation into thermal and chemical efficiencies of manufacture of different grades of gas by various processes. Work carried out at Windsor St. Works of Birmingham Gas Dept. to determine efficiency of production of carburetted water gas of calorific value of about 485 B.t.u. gross per cu. ft.; describes installation. See also Gas World, vol. 76, no. 1979, June 24, 1922, pp. 529-542, 5 figs.

WATER POWER

Resources Index Inventory System. Water Resources Index Inventory Filing System. Can. Engr., vol. 42, no. 27, July 4, 1922, pp. 667-671, 3 figs. Method developed by Dominion Water Power Branch for recording,c ollating and analyzing water resources data; cooperative investigations with provincial organizations; both graphical and written records.

WATER PURIFICATION

Denitrification by Bacteria. Denitrification by Bacteria. Pub. Works, vol. 53, no. 1, July 1, 1922, pp. 12-13. Abstract of report by K. Scheringa on work of Netherlands Central Laboratory. In making water analysis, nitrogen determination should be made as promptly as possible.

Microscopic Organisms, Destruction of. Prevention of Tastes and Odors Due to Microscopic Organisms, William W. Brush. Eng. and Contracting, vol. 62, no. 24, June 14, 1922, pp. 560-561, 2 figs. Successful use of copper sulphate and chlorine in treatment of New York's water supply. From paper read before Am. Water Works Assn.

WATER SUPPLY

Extension of Boston Water District. Proposed Extension of the Metropolitan Water District, X. H. Goodenough. New England Water Works Assn. Jl. vol. 36, no. 2, June 1922, pp. 189-256 and (discussion) 256-261, 15 figs. Consideration of all factors from which prediction of increases can be made and best means of meeting them.

New York Catskill Mountain. New York Catskill Mountain Water Supply, A. A. Northrop. Universal Engr., vol. 35, no. 6, June 1922, pp. 17-25, 12 figs. Outstanding features of problem and description of solution of various phases.

WATER TREATMENT

Copper Sulphate. Copper Sulphate Treatment for Preventing Alga. Growth in Lakes and Reservoirs, N. L. Huff. Eng. and Contracting, vol. 68, no. 2, July 12, 1922, pp. 33-36, 3 figs. Experiences at Fairmount, Minn. Blue-green scum formers. Method and amount of chemical required; results and precautions.

WATERPROOFING

Electric. Waterproofing by Electricity, Ismar Ginsberg. Color Trade Jl., vol. 11, no. 1, July 1922, pp. 1-6, 7 figs. Application of electro-osmosis in injection of waterproofing element within very thin internal structure of fibers of a material.

WATERWAYS

St. Lawrence River. Possibilities of St. Lawrence Seaway, Wm. L. Saunders. Can. Engr., vol. 43, no. 2, July 11, 1922, pp. 128-130. Comparisons with other waterways; project economically sound; lower rates for water-borne freight power feature; would serve large population. From address before joint mtg. of A.I.E.E. and A.S.M.E.

WELDING

Pure Iron for. Manufacture and Use of Commercially Pure Iron in Gas and Electric Welding, C. A. McCune. Am. Welding Soc. Jl., vol. 1, no. 6, June 1922, pp. 8-23, 19 figs. Five characteristics of wires for successful welding.

See also electric welding; electric welding, arc, thermit welding.

WELDS

Testing. The Scientific Side of Welding, E. Atkins, Welding Engr., vol. 7, nos. 5, 6 and 7, May, June and July 1922, pp. 28-29, 32; 22-25, 28; 32, 34-36, 38; 67 figs. partly on p. 39. May: Comparison of microstructure of iron and steel with microstructure of welded metal. June : Microscopic investigation of defects in welds; hammered welds; influences of impure gas. July: Resistance welds; contact and spot welding; welding wire for iron and steel. Lecture before British Acetylene and Welding Assn.

WIRE MANUFACTURE

Wet-Drawing Machines. Works of the Lancashire Wire Company, Limited. Iron and Coal Trades Rev., vol. 105, no. 2836, July 7, 1922, pp. 1-2, 5 figs. Illustrated description of design of wet-drawing machines in wire mill.

WOOD

Destruction by Marine Borers. Destruction by Marine Borers. Is the Port of New York in Danger? Mun. Engrs. Jl., vol. 8, Second Quarter, 1922, pp. 57-80, 7 figs. Discussion. Probability of infection, and hydrographic, biological and engineering investigations.

X

X-RAYS

Analysis of Materials. The X-Ray Examination of Materials, J. F. Driver. Elec. Rev., vol. 90, no. 2323, June 2, 1922, pp. 784-785, 11 figs. Use of Coolidge tube, 200,000 volts and 45 milliamperes makes possible examination of 4-in. cast iron. (Abstract.) Lecture before Nottingham Soc. of Engrs.

Engineering Index

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A

ABRASIVE WHEELS

Breakage, Causes of. Grinding Wheel Breakage and Its Causes, Harold E. Jenks. Am. Mach., vol. 57, nos. 3 and 4, July 20 and 27, 1922, pp. 98-100 and 144-146, 6 figs. What produces stresses resulting in wheel breakage; effect of overspeeding. Details of correctly mounted wheel; necessity for balance; whywheels are weakened by balancing weights.

Grinding Tests. Factors Affecting Wheel Action, H. W. Wagner. Abrasive Industry, vol. 3, no. 8, Aug. 1922, pp. 244-246, 2 figs. Account of tests conducted to determine grinding performance of wheels with various materials.

AERONAUTICS

Standardization. Aeronautical Standardization. Aviation, vol. 12, nos. 20 and 21, May 15 and 22, 1922, pp. 564-566 and 596-598, 2 figs. Standardization of materials, parts and tools desirable for mass production in emergencies suggested by two engineers experienced in factory as well as theoretical knowledge.

AIR

Pollution. Atmospheric Pollution, John B. B. Kershaw. Engineer, vol. 134, no. 3471, July 7, 1922, pp. 2-4, 1 fig. Observations made in 12 cities and towns, in which 31 soot and dust gages were installed, contained in report of Advisory Committee on Atmospheric Pollution. Also abstract of paper on Suspended Impurity in the Air, by J. C. Owens, containing description of instrument for measurement of suspended atmospheric pollution.

AIR COMPRESSORS

Rotary. New Rotary Air Compressor, E. Loewenstein. Mech. Eng., vol. 44, no. 9, Sept. 1922, p. 598, 2 figs. Describes new type with springless abutment blades. Results of tests undertaken at Goettingen Inst., Germany. Translated from Deutsche Optische Wochenschrift, vol. 8, no. 22, May 28, 1922, pp. 413-414.

Planche Rotary Compressor, Lucien Fournier. Mech. Eng., vol. 44, no. 6, June 1922, pp. 385-386, 8 figs. Describes rotary compressor, designed by French engineer, with disk piston moving in a conchoid. Translated from Génie Civil, vol. 80, no. 12, Mar. 25, 1922, pp. 275-277.

AIR PUMPS

Condensation. Investigations of Condensation Air Pumps (Untersuchungen an Kondensations-Luftpumpen), K. Hoefer. Forschungsarbeiten auf dem Gebiete des Ingenieurwesens, no. 253, 1922, 92 pp. 48 figs. Investigations to determine relative efficiency of piston, steam-jet and water-jet air pumps with regard to economy, safety in operation, weight and space requirement. Results demonstrate advantages of steam-jet air pumps.

Radojet Dry-Air. The "Radojet" Air-Pump. Mech. World, vol. 72, no. 1860, Aug. 25, 1922, pp. 130-131, 4 figs. Describes dry-air pump which can be used in place of any other type of air pump. It is an ejector combination comprising tubular ejector in first stage and radial-flow ejector in second stage.

AIRPLANE ENGINES

Valve Lift. Variation in Volumetric Efficiency of an Engine with Valve Lift, T. E. Tillinghast. Air Service Information Circular, vol. 4, no. 356, June 15, 1922, 11 pp., 7 figs. Experiments to determine (a) effect of changes in valve lift on volumetric efficiency, (b) effect of changes in compression ratio on volumetric efficiency, and (c) effect of changes in valve lift on engine performance.

AIRPLANE PROPELLERS

Design. Notes on Propeller Design, Max M. Munk. Aerial Age, vol. 15, nos. 8, 10, 12 and 13, May 1, 15, 29 and June 5, 1922, pp. 178-179, 225-226, 274-275 and 298-299, 1 fig. May 1: Energy losses of propeller. May 15: Distribution of thrust over propeller blade. May 29: Aerodynamical equations of propeller blade elements. June 5: Summary.

Stresses. Stresses in Airscrews due to Varying Engine Torque, John Case. Aeronautical Jl., vol. 26, no. 140, Aug. 1922, pp. 321-324. General analysis; values of constants; approximate calculations; bending moment due to acceleration; example.

AIRPLANES

Design, Economical. Aerodynamical Efficiency and the Reduction of Air Transport Costs, Bregnet. Aeronautical Jl., vol. 26, no. 140, Aug. 1922, pp. 307-313 and (discussion) 313-318. How to design airplanes which should reduce present rates of aerial freight by more than one-half.

Pressure Distribution. The Pressure Distribution over the Horizontal Tail Surfaces of an Airplane, 111, F. H. Norton and W. G. Brown. Nat. Advisory Committee for Aeronautics, report no. 148, 1922, 26 pp., 33 figs. Deals with distribution of pressure during accelerated flight of full-sized airplane, for purpose of determining magnitude of tail and fuselage stresses in stunting.

Structural Safety. Structural Safety During Curved Flight, Adolph Rohrbach. Nat. Advisory Committee for Aeronautics Tech. Notes, no. 107, Aug. 1922, 18 pp., 9 figs. Includes appendix with graphic determination of airplane speeds during rectilinear and curved flight, and propeller efficiency according to experiments with models. Translated from German.

ALCOHOL

Internal-Combustion Engines. Alcohol for Internal Combustion Engines. Engineers. vol. 133, no. 3463, May 12, 1922, p. 534. Account of experiments carried out with 95 volumes per cent alcohol by Empire Motor Fuels Committee.

ALLOY STEELS

Decomposition of Martensite. The Decomposition of Martensite into Troostite in Alloy Steel, Howard Scott. Blast Furnace and Steel Plant, vol. 10, no. 8, Aug. 1922, pp. 421-424, 3 figs. Effect of alloying elements on decomposition of martensite to troostite was determined by means of heating curves. Published by permission of Director of Bur. of Standards.

ALLOYS

Aluminum. *See Aluminum Alloys; Duralumin.*
Iron-Carbon. *See Iron Alloys.*
Nickel. *See Nickel Alloys; Monel Metal.*

ALUMINUM

Castings. Molds for Aluminum Castings. Am. Mach., vol. 56, no. 24, June 15, 1922, pp. 896-898. Brass foundry practice modified for light, brittle aluminum; advantages of green sand cores; die castings stronger; how to test aluminum castings.

ALUMINUM ALLOYS

Castings. Notes on Aluminum Alloys for Casting. Chem. and Met. Eng., vol. 27, no. 10, Sept. 6, 1922, pp. 501-503. Useful foundry alloys contain relatively low percentages of copper, zinc or both; tabulation of physical properties of aluminum alloys used in America and other common metals and alloys.

Copper-Silicon-Aluminum. Physical Properties of Some Copper-Silicon-Aluminum Alloys When Sand Cast, E. H. Dix and A. J. Lyon. Am. Soc. for Testing Matls. advance paper for meeting June 26-30, 1922, 17 pp. 15 figs. Results of investigation conducted by Engineering Division of Air Service, covering alloys of 3, 6 and 9 per cent silicon with 0, 2, 4 and 6 per cent copper, and with 2 per cent copper and 1 per cent manganese are summarized.

Molding. Molding Practice for Aluminum Alloys. Chem. and Met. Eng., vol. 27, no. 11, Sept. 13, 1922, pp. 555-557. Notes on what is considered best practice. From sales dept. condensed data prepared by Tech. Dept., Aluminum Co. of America.

ASPHALT

Specifications. Asphalt Specifications, Larcy M. Law. Can. Eng., vol. 43, no. 3, July 18, 1922, pp. 156-158. Includes specifications for test, in particular new penetration test. Also melting point and ductility standards. Paper read before convention of Am. Road Builders' Assn.

AUTOMOBILE ENGINES

Cooling Systems. Advantages of Evaporating Type of Cooling System, A. Ludlow Clayden. Automotive Industries, vol. 47, no. 11, Sept. 14, 1922, pp. 509-511, 2 figs. Describes steam-cooling system. Promises to be lighter, simpler and more efficient than conventional types; less likely to permit overheating and loss of water; no thermostats required; smaller radiator can be used.

HEAVY-FUEL. The Use of Crude Oil for Fuel in Automobile Engines (Verwendung von Rohöl als Betriebsstoff für Fahrzeugmotoren), Gustav Kunzel. Motorwagen, vol. 25, nos. 19-20, July 10-20, 1922, pp. 371-372, 2 figs. Describes carburetor which is recommended for use of heavy crude oils.

IGNITION. See Ignition.

OVERHEAD CAMSHAFT EFFICIENCY. Do Overhead Camshafts Increase Efficiency in Engine Operation? P. M. Heldt. Automotive Industries, vol. 46, nos. 21 and 22, May 25 and June 1, 1922, pp. 1109-1144 and 1158-1161, 22 figs. Design leads to symmetrical engine of easy accessibility which need not be noisy. Used by four American makers and common in European practice. Read before Soc. Automotive Engrs.

AUTOMOBILE FUELS

See Alcohol, Gasoline.

AUTOMOBILES

CAMPING CARS. Designing Camping Cars and Trailers, Herry W. Perry. Automotive Industries, vol. 47, no. 7, Aug. 17, 1922, pp. 324-327, 4 figs. Ideas about design of suitable trailer camping outfits.

B

BALANCING MACHINES

DYNAMIC. Dynamic Balancing Machine. Machy. (Lond.), vol. 20, no. 515, Aug. 10, 1922, pp. 574-577, 5 figs. Describes Lawaczeck & Hermann machine; attainment of balance at all speeds; first test of balance; plane of unbalance; sensitiveness of machine.

MARTIN. Balancing of High-Speed Machine Parts (Het uitbalanceeren van snel roteerende machinedeelen), W. Hamilton Martin. Ingenieur, vol. 37, no. 30, July 29, 1922, pp. 587-593, 7 figs. Static and dynamic balancing of rotating parts; Martin balancing machines.

BELTING

LEATHER. New Federal Specification for Leather Belting. Belting, vol. 21, no. 2' Aug. 1922, pp. 15-19, 1 fig. Adoption by Government intended to set first regular standards for users of products, manufacturers and distributors.

BEARINGS, BALL

POWER CONSUMPTION. Tests on the Power Consumption of Ball and Journal Bearings for Driving Gear Shafts (Versuche über den Energiebedart von Kugel- und Gleitlagern an Triebwerkswellen) M. Gohlke. Maschinenbau, vol. 1, no. 7, July 8, 1922, pp. 447-451, 7 figs. Results of tests show that ball bearings save about 50 per cent of work of friction of shaft, have longer life and lighter starting.

BLASTING

COMMINUTED SMOKELESS POWDER. Comminuted Smokeless Powder as a Blasting Agent, C. E. Munroe and Spencer P. Howell. U.S. Bur. of Mines Reports of Investigations, no. 2386, Aug. 1922, 19 pp. Describes physical and chemical properties; gives precautions to be observed in handling and packing it, and in preparing cartridges and boreholes in its use. Results of field tests in blasting stumps, boulders, and ditches.

FAILURE OF CENTER SHOTS. Failure of Center Shots in Blasting. L. C. Illsley and A. B. Hooker. U.S. Bur. of Mines Reports of investigations, no. 2384, Aug. 1922, 10 pp. Tests made by electric section of Bur. of Mines, which may be helpful in understanding probable cause of misfiring of center shots.

BLAST FURNACES

RECONSTRUCTION. Rebuilding Emporium Blast Furnace. Iron Trade Rev., vol. 71, no. 10, Sept. 7, 1922, pp. 651-653, 3 figs. Emporium Iron Co. discards hand-filling system and installs modern mechanical equipment. New construction includes storage bins, skip hoist, furnace top and pig-casting machine.

BLOWERS

FORCED-DRAFT FURNACES. Tests on a Forced-Draft Furnace (Versuche an einer Unterwindfeuerung), E. Philipp. Feuerungstechnik, vol. 10, no. 20, July 15, 1922, pp. 224-226, 3 figs. Describes Schlotter blowers, built by Siemens-Schukert Works, with air duct in axial direction; and installation in Wiesbaden electricity works equipped with these ventilators.

BOILER FEEDWATER

SOFTENING. Softening Boiler-Feed Water with Zeolites. Power, vol. 56, no. 11, Sept. 12, 1922, pp. 412-414, 4 figs. How zeolites remove hardness; details of operation data on typical installation, combination lime-zeolite treatment for water high in temporary hardness.

BOILER HOUSES

SUGAR-REFINING CO. The Boiler House of the American Sugar Refining Company at Baltimore, Maryland, E. B. Powell. Mech. Eng., vol. 44, no. 8, Aug. 1922, pp. 509-512, 4 figs. General features of plant; boilers, feedwater system; instruments; combustion equipment. (Abridgment). See also Steam, vol. 30, no. 3, Sept. 1922, pp. [illegible].

BOILER OPERATION

HEAT LOSSES. The Control of Boiler Operation, E. A. Uehling. Mech. Eng., vol. 44, no. 7, July, [illegible] simplified formulas for use in calculating chimney, combustion and absorption losses. Proposed fuel unit for bituminous coal [illegible].

BOILER PLANTS

PERFORMANCE TESTS. Fuel Economy from Old Plant Equipment, A. R. Mumford. U. S. Bur. of Mines [illegible] Gives results of tests [illegible]

REBUILDING. Rebuilding a [illegible] Plant Without Interrupting the Service, Alfred Iddles and J. Walter May. Power, vol. 56, no. 11, Sept. 12, 1922, pp. 402-408, 11 figs. Modern boiler plant, containing five water-tube boilers, each of [illegible] old plant, without interfering with capacity of plant and without interrupting service supplied to [illegible].

STIRLING. The Stirling Boiler Plants of the Gennevilliers Central Station (Les chaufferies Stirling de la centrale de Gennevilliers), Jean Labadié. Revue Industrielle vol. 52, nos. 8 and 9, June and July 1922, pp. 249-255 and 285-291, 14 figs. Notes on boilers, furnaces economizers, stoking arrangements, etc., and their operation.

BOILERS

HIGH-PRESSURE. High-Pressure Boilers for the Waukegan Power Station. Power, vol. 56, no. 11, Sept. 12, 1922, pp. 417-418, 1 fig. Boilers, each having 14,086 sq. ft. of water-heating surface of new design for 400-lb. pressure, which allows use of metal thicknesses in pressure parts no greater than in boilers designed for ordinary pressures.

PRACTICE IN 1922. Boiler Practice. Assn. Iron and Steel Elec. Engrs., vol. 4, no. 9, Sept. 1922, pp. 521-543, 3 figs. Symposium of following articles; The Trend of Boiler Development, J. B. Crane. Boiler Practices of 1922, R. E. Butler. The Modern Sectional Header Boiler, R. M. Rush. Heine Boiler Practice in 1922, E. R. Fish and Alfred Cotton.

TESTS, ACCURACY OF. The Accuracy of Boiler Tests, Alfred Cotton. Mech. Eng., vol. 44, no. 7, July 1922, pp. 427-430 and (discussion) p. 437, 1 fig. Points out unavoidable inaccuracies involved in reports of boiler tests and absurdity of assigning values carried out to one-hundredth of one per cent to items which cannot possibly be measured so closely. Discusses factors entering into boiler-test computations. (Abridgment.)

BOILERS, WATER-TUBE

IMPROVEMENTS. Improved Water-Tube Boilers. Engineer, vol. 134, no. 3477, Aug. 18, 1922, pp. 166-168, 6 figs. Details of and alterations in Nesdrum water-tube boilers built by Richardsons, Westgarth & Co., Middlesbrough.

BORING TOOLS

PRESSURE. Chart for Determining the Pressure Exerted by Boring Tools, J. B. Conway. Mech. World, vol. 72, no. 1860, Aug. 25, 1922, pp. 127-128, 1 fig. For purpose of determining end thrust and cutting pressure exerted by one- and two-lipped boring tools.

BRASS

DEZINCIFICATION. The Dezincification of Brass, Ralph B. Abrams. Am. Electrochem. Soc. advance paper for meeting, Sept. 21-23, 1922, no. 1, 12 pp. Account and results of investigation.

PROPERTIES. The Nature of Brass, A. E. White. Engrs. Soc. of West. Pa. Proc., vol. 38, no. 1, Feb. 1922, pp. 7-25 and (discussion) 25-34, 24 figs. Properties of brasses and extent to which these properties are varied by cold working and by different degrees of annealing; fundamental laws under which grain growth in metals may occur.

BRICK

CONCRETE. Report of Committee C-3 on Brick. Am. Soc. for Testing Matls. advance paper for meeting June 26-30, 1922, 9 pp., 3 figs. Proposed tentative specifications for concrete building brick.

FURNACES, MALLEABLE. Bricks for Malleable Furnaces, H. G. Schurecht. Foundry, vol. 50, no. 17, Sept. 1, 1922, pp. 707-710, 7 figs. Results of laboratory tests. Load and softening tests are not reliable criterions of behavior of brick in service, whereas spalling tests bears close relation to service test. From paper read before Am. Foundrymen's Assn.

POROSITY, DETERMINATION. A Simple Control Porosimeter, G. A. Bole and F. C. Jackson. Brick and Clay Rec., vol. 61, no. 5, Sept. 5, 1922, pp. 314-315, 2 figs. Apparatus for quickly and accurately determining porosity of any clay ware; planned for paving brick, but serviceable for any product.

BRIDGE DESIGN

CIRCULAR BRIDGES. The Design of Circular Bridges — Bridges with Continuous Spans. Ferro-Concrete, vol. 8, nos. 9 and 10, Mar. and Apr., 1922, pp. 255-261 and 285-288, 2 figs. Theoretical design and formulas.

BRIDGE ERECTION

FLOATING ERECTOR. Telescoping Tower on Scow Shifts Arch Centers. Eng. News-Rec., vol. 89, no. 8, Aug. 24, 1922, pp. 300-301, 3 figs. Ten. steel centers used for spans of new Harrisburg bridge across Sysquehanna; set up twice under each of 46 arches; scow trips of 3,000 ft. with 60-ton centers assembled.

BRIDGES, CONCRETE

ARCH. Special Form Work for Black Street Bridge, Hamilton, Ont. Eng. and Contracting, vol. 58, no. 8, Aug. 23, 1922, pp. 173-175, 3 figs. Details of 7-span concrete arch structure, 654 ft. between abutments, built by Miami Conservancy District. (Abstract.) Miami Conservancy Bul., July, 1922.

BRIDGES, LIFT

BASCULE. Bascule Highway Bridge, Port Dover, Ontario, E. H. Darling. Can. Engr., vol. 43, no. 9, Aug. 29, 1922, pp. 295-297, 9 figs. Plate girder bascule span and two reinforced-concrete spans; total length, 142 ft. Construction details.

BRIDGES, HIGHWAY

CONCRETE. Design and Construction of Six-Span Reinforced Concrete Highway Bridge Crossing Wabash River at Attica, Indiana, H. A. Hanapel. Mun. and County Eng., vol. 63, no. 2, Aug. 1922, pp. 37-44, 4 figs. Total length, 986 ft.; solid arches with 12-in. sidewalls and counterfeits supporting cantilevered brackets and 6-in. sidewalk; roadway provides 20-ft. driveway with 5-ft. sidewalk on each side.

STEEL. Annapolis River Bridge, Annapolis Royal, N.S., E. M. Archibald. Can. Engr., vol. 43, no. 4, July 25, 1922, pp. 171-173, 5 figs. Highway structure of 11 through-truss riveted spans erected on ice piers ten years old. Disintegration of piers through combination of sea water, frost and erosion. Superstructure floated into position on scows.

SUSPENSION. Building the Rondout Creek Highway Suspension Bridge, W. E. Joyce and M. Bebarfald. Eng. News-Rec., vol. 89, no. 11, Sept. 14, 1922, pp. 424-428, 7 figs. Concrete-floor highway bridge of 705-ft. span; stiffening trusses continuous over three spans; method of spinning 9¼-in. wire cables.

BRIDGES, RAILWAY

LOCOMOTIVE LOADINGS. Locomotive Loadings for Railway Bridges, D. B. Steinman. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 5, May 1922, pp. 1043-1073, 14 figs. and 9 plates. Presents new loading system based on study of stress-producing effects of modern heavy locomotives.

Steel. The New Regulations of the German State Railway for the Design and Calculation of Steel Railway Bridges, Fr Voss Bauingenieur, vol 3, no. 14, July 31, 1922, pp 441-444, 5 figs General regulation for calculation of strength and drawings; assumed loads; permissible stresses

BRONZES

Manganese. Manganese Bronze, F. A. Livermore, Foundry Trade Jl., vol. 26, no. 310, July 27, 1922, pp. 83-84 Practical suggestions as to manufacture and tests of physical properties

BUILDING CONSTRUCTION

Brickwork, Cost Estimating. Estimating the Cost of Brickwork, Chas. F. Dingman Contract Rec., vol 36, no. 34, Aug 23, 1922, pp 834-839 How a bid should be computed. Factors involved in brick laying. Data covering labour operations. Why brickwork material estimates vary.

Labour-Cost Estimation Estimating Labor Costs on Building Construction, Gordon M Tamblyn. Eng and Contracting, vol 58, no 4, July 26, 1922, pp. 88-91. Writer suggests a few particular points found to be of great help in making estimates, which tend to lessen danger of overlooking or duplicating items. Presents so-called labour constants and gives examples of their use. Introductory chapter to Building Labour Calculator.

Progress Chart. Cutting Costs with the Progress Chart, H. N. Snow. Contract Rec., vol. 36, no. 31, Aug. 2, 1922, pp. 785-786, 2 figs. Use in Building operations and method of handling.

Waste Elimination. How to Eliminate Waste in Construction Industry, D. Kinckerbacker Boyd. Eng. and Contracting, vol. 58, no. 4, July 26, 1922, pp. 82-84, 1 fig. Practical suggestions for large savings. Paper presented before Am. Construction Council.

C

CABLES, ELECTRIC

Aluminum. Aluminum Overhead Transmission Lines. Elec. Rev., vol. 91, no. 2334, Aug. 18, 1922, pp. 220-222, 5 figs. Describes particular advantages of steel-cored aluminum after referring briefly to chief characteristics of plain aluminum cables.

CABLEWAYS

Suspended Cars. Suspended Elevators and Ferries (Schwebelift und Schwebefähre), Richard Petersen. Verkehrstechnik, vol. 39, no. 31, Aug. 4, 1922, pp. 401-405, 5 figs. Describes new German patents for conveyance of passengers and freight between two stations whose beeline connections is high over surface of earth. Suspended elevators connect station on cliff with one in valley, whereas suspended ferries connect two sides of a deep valley. Results of model tests.

CARWHEELS

Chilled-iron, The Griffin Wheel (Das Griffinrad). Emil Rüker. Glasers Annalen, vol. 91, no. 3, Aug. 1, 1922, pp. 33-43. Statistics on fracture of tire and life of wheels. Investigation of speed limits, maintenance costs, influence of continuous braking of trains. Experiences in practice and workshop. Bibliography.

CARS

Self-Propelled. Self-Propelled Cars on Steam Railways. Can. Ry. and Mar. World, no. 294, Aug. 1922, pp. 417-419, 4 figs. Description of equipment on Can. Nat. Rys. This equipment is both of American and Canadian origin.

CARS, FREIGHT

Design. Some Factors to be Considered in Freight Car Design, H. W. Williams. Ry. Rev., vol. 71, no. 9, Aug. 26, 1922, pp. 269-271. Evolution of design leading toward standardization and reduction in weight.

CARS, REFRIGERATOR

Design and Operation. Some Notes on Railway Refrigerator Cars, W. H. Winterrowd. Mech. Eng., vol. 44, no. 7, July 1922, pp. 419-426, 13 figs. Facts relating to principles of railway refrigerator-car operation and information about various types of cars and methods of design and construction. (Abridgment.)

Mechanical Refrigeration of. Refrigeration of Railroad Cars, W. M. Baxter. Mech. Eng., vol. 44, no. 9, Sept. 1922, pp. 570-574, 8 figs. Technical, economic and operating aspects of various attempts to employ mechanical refrigeration in railroad refrigerator cars with details of proposed dense-air system for that purpose. (Abridgment.)

Santa Fe Railway. New Designs of Refrigerator Cars for the Santa Fe. Ry. Age, vol. 73, no. 5, July 29, 1922, pp. 189-193, 10 figs. Include two similar types, one with movable, other with stationary bulkheads. See also Ry. Mech. Engr., vol. 96, no. 8, Aug. 1922, pp. 455-459, 10 figs.

CARS, TANK

Acid. Tank Cars for Transportation of Muriatic Acid, J. M. Rowland. Chem. Age, vol. 30, no. 7, July 1922, pp. 299-301, 3 figs. Description of construction of car and discussion of lining with particular reference to unvulcanized para rubber linings.

CASE-HARDENING

Localized. Problems in Localized Case Hardening, R. A. Millholland. Iron Age, vol. 110, no. 5, Aug. 3, 1922, pp. 265-266. Low-carbon machine steel used; after carburization and annealing, material to be removed machinable and not distorted in subsequent hardening.

Prevention. Methods for Locally Preventing Case Hardening, Jean Galibourg and Marcel Ballay. Iron Age, vol. 110, no. 3, July 20, 1922, pp. 136-137. Protective layers applied with brush and coating with copper compared by French authorities. Translated from Revue de Métallurgie, Apr. 1922.

CAST IRON

Chemical Composition. Cast Iron and Its Chemical Composition, O. Smalley. Engineering, vol. 114, no. 2957, Sept. 1, 1922, pp. 277-281, 22 figs. Notes on semi-steel; oxygen in cast iron; casting temperatures; solidity of cast-iron; effect of composition on strength of cast-iron hot, etc. Paper read before British Foundrymen's Assn.

Electric-Furnace Production. Cast Iron as Produced in the Electric Furnace, and Some of Its Problems, George K. Elliott. Chem. and Met. Eng., vol. 27, no. 3, July 19, 1922, pp. 116-120. Basic electric furnace is useful to refine cupola-melted iron, reducing sulphur and gases to any extent desired, and producing easily machinable castings, very tough and strong, and with minimum of defectives from dirt or blowholes. Paper read before Am. Electrochem. Soc.

Low Temperature, Influence of. Some Influences of Low Temperature on the Strength and Other Properties of Cast Iron, A. Campion. Foundry Trade Jl., vol. 26, no. 308, July 13, 1922, pp. 32-36, 2 figs. Results of tests made on irons of different qualities and compositions; on repeated heating and cooling, changes of weight were found.

Melting. Heat Factors Govern Melting, Y. A. Dyer. Foundry, vol. 50, no. 16, Aug. 15, 1922, pp. 661-662. Importance of thermophysics in melting, superheating, pouring and cooling iron illustrated by effects enumerated and study of results obtained from combustion of coke in cupola.

Nickel-Chromium, Effect of. Effect of Nickel-Chromium on Cast Iron, Richard Moldenke. Am. Inst. Min. & Met. Engrs. Trans., no. 1187-S, Sept. 1922, 23 pp., 12 figs.; and (abstract) in Min. & Metallurgy, no. 189, Sept. 1922, pp. 54-55, 3 figs. Describes making of pig iron from Mayari iron ores of Cuba, and gives tables of results of tests, series of curves showing interrelation of elements involved, and summary of conclusions derived.

Specifications. Report of Committee A-3 on Cast Iron. Am. Soc. for Testing Matls. advance paper for meeting June 26-30, 1922, 14 pp., 2 figs. Proposed tentative specifications for chilled cast iron wheels, foundry pig iron and high-test gray-iron castings.

Steel Scrap in Cupola. Steel Scrap in Cupola Iron Mixtures, E. J. Lowry. Iron Age, vol. 110, no. 6, Aug. 10, 1922, pp. 337-338, 3 figs. Strength of product and percentages of scrap. Experiments and results. Effect on hardness.

CASTING

Centrifugal. Centrifugal Casting, Leon Cammen. Mech. Eng., vol. 44, no. 8, Aug. 1922, pp. 500-504, 4 figs. Résumé of development and discussion of design and operating problems of centrifugal-casting processes and their field of application. Manufacture of plates by this process. (Abridgment.)

CELLULOSE

Wood. Contributions to Chemistry of Wood Cellulose, Louis E. Wise and Walter C. Russell. Jl. Indus. & Eng. Chem., vol. 14, no. 4, Apr. 1922, pp. 285-287. Compares chemical properties of wood cellulose and cotton cellulose by means of spruce pulp, which yields appreciable amounts of cellulose octacetate on acetolysis, as does cotton.

CENTRAL STATIONS

Superpower. The Gennevilliers Plant and the Distribution of Electric Energy in the Paris District (L'Usine de Gennevilliers et la distribution de l'énergie électrique dans la région Parisienne), F. Loppé. Industrie Électrique, vol. 31, no. 722, July 25, 1922, pp. 265-276, 10 figs. Describes buildings, boiler house, 50,000-hp. turbo-alternators, 50,000-hp. turbines, etc.

CEMENT MILLS

Iron and Steel, Application of. Iron and Steel Application to the Cement Industry, W. R. Shimer. Cement, Mill & Quarry, vol. 21, no. 2, July 20, 1922, pp. 31-34. Special steel recommended; heat-treated steel for shovels, gyratories, and in places where wear is encountered.

CHIMNEYS

Compound. The Nast System of Compound Chimneys (Die schalungslose Verbundbauweise "Nast"), Paul Frei. Beton u. Eisen, vol. 21, nos. 5 and 6, Mar. 18 and Apr. 5, 1922, pp. 78-81 and 90-91, 7 figs. Mar. 18: Construction of reinforced-concrete stacks; improvements introduced by patent of B. Nast. Apr. 5: Describes chimneys 62 to 117 m. high at Oppau works, all of which passed through explosion unharmed.

CHROMIUM STEEL

Corrosion, Resistance to. Resistance to Corrosion of Various Types of Chromium Steels, Henry S. Rowdon and Alexander I. Krynitsky. Chem. & Met. Eng., vol. 27, no. 4, July 26, 1922, pp. 171-173. Abstract of research carried out at Bur. of Standards. Corrosion in air differs from that in dilute hydrochloric acid.

Solidification, Speed of. The Influence of Speed of Solidification on Double-Carbide Steels (Ueber den Einfluss der Ertsarrungsgeschwindigkeit auf die Doppel-Karbidstähle) P. Oberhoffer. Stahl u. Eisen, vol. 42, no. 32, Aug. 10, 1922, pp. 1240-1242, 6 figs. Results of tests carried out on a series of chrome steels.

CIRCUIT BREAKERS

Oil. Considerations Relating to the Design of Oil Circuit Breakers, D. R. Davies. Electrician, vols. 88 and 89, nos. 2300, 2303 and 2307, June 16, July 7 and Aug. 4, 1922, pp. 712-714, 6-8 and 124-125, 10 figs. Methods for reducing losses; estimating maximum temperature rise of small conductors during short circuit. Repulsive effects produced by large currents in oil circuit breakers. Summary of factors limiting ultimate interrupting capacity.

CITY PLANNING

Problems. The Engineer and the Town Plan, James Ewing. Eng. Jl. (Eng. Inst. Can.), vol. 5, no. 8, Aug. 1922, pp. 412-414 and (discussion), pp. 415-417. Importance of planning for future; transportation and street-traffic problem zoning; parks and playgrounds.

CLAY

Industries and Mining. Clay-Working Industries, Clay, and Silica Brick in 1919 and 1920, Jefferson Middleton. U. S. Geol. Surv., 11:33, Aug. 14, 1922, pp. 323-359, 1 fig. Deals with products of clay-working industries as well as clay mining.

CLAY PRODUCTS

Soluble Salts in. Soluble Salts in Clay Wares, C. W. Parmelee. Brick & Clay Rec., vol. 61, nos. 4 and 5, Aug. 22 and Sept. 5, 1922, pp. 249-252 and 316-318. Discussion of standard terms on deposits formed on surface of burned clay; suggestions for overcoming this defect and explanation of why barium compounds are used. Address before Am. Face Brick Assn.

COAL

Carbonization. The Carbonization of Coal, R. Lessing. Fuel in Sci. & Practice, vol. 124, no. 3214, Aug. 25, 1922, pp. 137-149, 8 figs. Notes on destructive distillation of coal; volatile products of carbonization; influence of flue gases; effect of catalysis; use of steam during carbonization; carbonization in gas works and coke ovens; low-temperature carbonization; complete gasification; etc. Lecture delivered in Dept. of Fuel Technology at Sheffield University.

Spontaneous Combustion. Factors in the Spontaneous Combustion of Coal, O. P. Hood. U. S. Bur. of Mines Tech. Paper, no. 311, 1922, 9 pp., 8 figs. Notes on size of coal, temperature at time of storage, freshness of coal surface, rise of temperature to danger point, dissipation of heat generated, etc. Publications on heating and deterioration of stored coal.

COAL HANDLING

Haulage, Hoisting and Dumping. Cambria Steel Co. Drops Coal Down Well, Loads It at Bottom and Hauls It to Ovens, George A. Richardson. Coal Age, vol. 22, no. 9, Aug. 31, 1922, pp. 313-317, 7 figs. Coal is passed down 110-ft. shaft from upper bed to lower and is reloaded for 2-mile run to Rosedale ovens; electrically actuated gates load through measuring hopper.

Pit Car Loaders. Mechanical Pit Car Loaders, Reginald Trautschold. Coal Industry, vol. 5, no. 6, June 1922, pp. 283-285, 4 figs. Mechanical loading device will operate to greatly reduce mining costs of given proper chance, but good management is essential to success; types of loaders and operating data.

Turntables, Use of. Enlisting the Turntable in Mechanical Coal Loading, E. N. Zern. Coal Age, vol. 22, no. 8, Aug. 24, 1922, pp. 283-285, 2 figs. Turntable is located on room track opposite line of crosscuts which intersect five consecutive rooms and give a storage road for cars near loading machine.

COAL MINING

Safety Methods. Keeping Up to Date in Safety Methods in Coal Mining, D. Harrington. U. S. Bur. of Mines Reports of Investigations, no. 2372, July 1922, 2 pp. Recommendations for safe methods.

COAL STORAGE

Cable Drag-Scraper Method. Coal Handling by Drag Scraper, C. W. Ross. Gas Age-Rec., vol. 50, no. 8, Aug. 19, 1922, pp. 230-232, 6 figs. Suggestions for storage so as to prevent spontaneous combustion; methods of storing; cable drag-scraper storing system.

Experiments. Experiments in Coal Preservation, M. Forrières. Gas Jl., vol. 159, no. 3092, Aug. 16, 1922, pp. 375-376 Results of very complete laboratoy experiments carried out with view of determining behaviour of similar coals, stored with free access to air circulation, with restricted air circulation, and under water.

COKE MANUFACTURE

By-Product. By-product Coking, F. W. Sperr, Jr. Jl. Indus. & Eng. Chem., vol. 14, no. 9, Sept. 1922, pp. 844-846. Property and process of coking; by-product formation; properties and utilization of coke; materials of plant construction.

COLD STORAGE

Research. The Low Temperature Research Station at Cambridge, L. F. Newman. British Cold Storage & Ice Assn., vol. 18, no. 2, 1921-1922, pp. 5-17 and (discussion) 18-28 Investigation of entire problem of cold-storage losses and description of new station.

COLUMNS

Reinforced-Concrete. Slenderness-Ratio and Strength of Concrete Columns, F. E. Giesecke. Eng. News-Rec., vol. 89, no. 7, Aug. 17, 1922, pp. 274-276, 7 figs. Effect of length found to be negligible; influence of water ratio and mixing; buckling controlled by eccentric loading.

COMBUSTION

Maximum Temperature Calculation. Rapid Calculation of Theoretical Maximum Temperatures, George Granger Brown. Chem. & Met. Eng., vol. 27, no. 10, Sept. 6, 1922, pp. 497-500, 3 figs. Four methods for computing temperature developed by a reaction; graphical, by trial, algebraic, and slide rule. From paper read before Am. Chem. Soc.

CONCRETE

Aggregate, Limestone. Report of Tests on Limestone Aggregate. Concrete Products, 23, no. 2, Aug. 1922, pp. 59-61, 3 figs. Results of tests made by Eng. Research Laboratory, Univ. Texas, with soft limestone having unit compressive strength of about 6,000 lb., in comparison with harder limestone having unit compressive strength of about 18,000 lb., showing that 28-day strength of concrete made with soft was as great as that made with harder.

Alkali Effects. Drain Tile Tests Show Concrete Affected by Alkali. Eng. News-Rec., vol. 89, no. 5, Aug. 3, 1922, p. 181. Report of observations on test tile placed in 1913 in alkali soils through 1920.

Gas Water, Effect. Destructive Action of Gas Water on Concrete (Zerstörender Angriff auf Beton durch Gaswasser), Robert Mezger. Bauingenieur, vol. 3, no. 13, July 15, 1922, pp. 408-412. Results of experiences in gas works of Stuttgart, Germany. Measures for protecting concrete.

Mixtures, Design of. Design of Concrete Mixture Without Use of Abrams' Tables, H. C. Boyden. Eng. & Contracting, vol. 58, no. 4, July 26, 1922, pp. 91-93, 3 figs. Present information for solution of problems liable to come up in design of concrete mixtures.

Products, Tests on. Need for Tests on Concrete Products, Wallace R. Harris. Concrete Products, vol. 23, no. 1, July 1922, pp. 39-40. Development of industry requires exact knowledge of physical properties.

Quality Control. Controlling Quality of 400,000 Cu. Yds. of Concrete, Roderick B. Young. Concrete, vol. 21, no. 1, July 1922, pp. 3-6, 3 figs. Saving 50,650 barrels of cement and obtaining specified strengths at 28 days by definite control of proportions on Queenston-Chippewa hydro-electric development.

CONCRETE BLOCKS

Manufacturing Methods, Equipment. Modern Equipment Reduces Labour Costs, Raymond P. Bigelow. Concrete Products, vol. 23, no. 1, July 1922, pp. 33-35, 4 figs. Ways and means adopted to obtain maximum production in concrete products plant of Garland Block & Sand Co., Youngstown, Ohio.

CONCRETE CONSTRUCTION

Cost Estimate. Estimating the Cost of Plain Concrete Work in Buildings, Chas. F. Dingman. Contract Rec., vol. 30, July 26, 1922, pp. 726-730. Methods of calculating quantities and figuring costs; analysis of factors involved in forming and concreting operations.

Forms. How to Make Forms for Concrete Buildings, Wm. F. Lockhardt. Concrete, vol. 20, nos. 2, 3, 4, 5 and 6, Feb., Mar., Apr., May, June, July and Aug. 1922, pp. 56-58, 113-115, 164-169, 191-197, 239-242, 14-16 and 44-46, 51 figs. Feb.: Footings. Mar.: Walls. Apr.: Columns. May: Beams and girders. June and July: Flat slabs. Aug.: Belt courses and cornices.

CONCRETE CONSTRUCTION, REINFORCED

Water-Holding Structures. Concrete for Water-Holding Structures, H. C. Ritchie. Contract Rec., vol. 36, nos. 33 and 34, Aug. 16 and 23, 1922, pp. 818-821 and 844-846. Special problems in use of material for such purposes. States that it is possible to so use concrete as to make it waterproof of itself. Economy of reinforced concrete in capital cost and concrete. Discussion. Paper read before (Brit.) Instn. Water Engrs.

CONCRETE, REINFORCED

Diagrams. Simplified Reinforced Concrete Diagrams, Eugene F. Delery. La. Eng. Soc. Proc., vol. 8, no. 3, June 1922, pp. 119-137, 3 figs. Presents charts developed by author with object of securing simple, yet comprehensive, set of curves for rapid calculations and comparisons for varying conditions of stress in both steel and concrete.

Inspection Rules for. Report of Committee C-2 on Reinforced Concrete. Am. Soc. for Testing Matls. advance paper for meeting June 26-30, 1922, 8 pp. Proposed tentative rules for inspection of concrete and reinforced-concrete work.

Slabs. Design of Reinforced Concrete Slabs, Howard Harding. Engrs. & Eng., vol. 39, no. 6, Aug. 1922, pp. 302-306, 6 figs. Describes use of diagram for graphic solution of reinforced concrete slabs. Paper read before Rochester Eng. Soc.

CONDENSERS, STEAM

Air Extractors. Tests on Delas Air Extractor. Iron & Coal Trades Rev., vol. 105, no. 2839, July 28, 1922, pp. 116-117, 5 figs. Inventor has stabilized extractor by method of introducing external cold-water circulation instead of atmospheric air into divergent.

Surface. Surface Condensing Plant. Engineer, vol. 134, no. 3473, July 21, 1922, pp. 70-72, 9 figs. Described new installation in Pinkston power station of Mirrlees Watson surface condenser, designed to work with 10,000-kw. 1500-rev. turbo-generator, and capable of maintaining vacuum of 27.8 in., with cooling water at 75 deg. fahr. when dealing with 185,000 lb. of steam per hr.

COPPER ORE

Heap Leaching. Heap Leaching of Low-Grade Copper Ores, Joseph Irving. Eng. & Min. Jl.-Press, vol. 113, nos. 17 and 18, Apr. 29 and May 6, 1922, pp. 714-721 and 774-777, 10 figs. Success of process in Spain led to trials in Bisbee district, Arizona. Over 70 per cent of copper extracted from ore containing 27 lb. per ton.

CORROSION

Metals and Alloys. Preliminary Notes on Corrosion, Wilder D. Bancroft. Am. Soc. for Testing Matls. advance paper for meeting June 26-30, 1922, 5 pp. Points out desirability of developing rapid method for studying corrosion.

Prevention by Deoxidizing Metals. Prevention of Corrosion of Metals by Water in a Closed System, Perry West. Jl. Indus. & Engr. Chem., vol. 14, no. 7, July 1922, pp. 601-607, 7 figs. Metals rust to appreciable degree only when in contact with both water and free oxygen. Removal of this oxygen will in most cases practically stop corrosion, and in other cases materially reduce corrosion caused by other agencies.

COST ACCOUNTING

Factory. Cost Accounting and Factory Efficiency, George P. Comer. Chem. & Met. Eng., vol. 27, no. 9, Aug. 30, 1922, pp. 417-421. Control of production; basic schemes of distribution; essential elements of cost; departmental cost sheet; costs of idle equipment; cost and sales summary; uniform cost systems.

Rolling-Stock Production. Railway Carriage and Wagon Building Costs. Ry. Engr., vol. 43, no. 511, Aug. 1922, pp. 289-294, 17 figs. New system installed at works of Midland Ry., Derby, for ascertaining and checking rolling-stock production costs.

CRANES

Cableway. Cableway Cranes (Kabelkrane), Friedrich Riedig. Fördertechnik u. Frachtverkehr, vol. 15, no. 15, July 21, 1922, pp. 195-201, 15 figs. Use of cableway cranes for building of bridges, dams, harbors, canals, etc.; for loading of bulk goods; and for shipbuilding. Efficiency of such cranes and comparison with loading bridges.

Workshop. The Louden-King Push-and-Pull Crane, George F. Zimmer. Eng. and Indus. Management, vol. 8, no. 3, Aug. 24, 1922, pp. 95-97, 7 figs. Overhead, hand-operated crane for loads up to 1000 lb.

CUPOLAS

Hot-Blast. Utilizing Heat of the Cupola to Warm the Blast. Can. Foundryman, vol. 13, no. 8, Aug. 1922, pp. 18-19, 3 figs. By having cast-iron jacket above melting zone, air is heated from waste heat of fuel, before passing into fire.

CUTTING TOOLS

Diamond. Diamond Tools as Cost Reducers. Machy. (N.Y.), vol. 29, no. 1, Sept. 1922, pp. 33-37, 7 figs. Gives brief description of preparation of diamonds for commercial use, indicates how they are set in holders, and furnishes information regarding their cost. Multiple-stone diamond dresser for emery wheels.

CYLINDERS

Metal-Faced Cores. Using Metal Faced Cores in Cylinders. Foundry, vol. 50, no. 16, Aug. 15, 1922, pp. 684-685, 4 figs. Patent claim of T. P. Greenhow is based on method of application and preparation employed to cover metal face of core to prevent metal from chilling. Method has been applied at plant of Buick-Motor Co., Flint, Mich.

Welded, Testing. Tests on Welded C[illegible] [illegible] and H. J. B[illegible]. Mech. Eng., vol. 44, no. 9, Sept. 1922, [illegible] 14 figs. Describes [illegible]

D

DAMS

Arch Calculation. Calculation of Arch Dams (Notes sur le calcul des barrages en voute), G. Pigeaud. Génie Civil, vol. 81, no. 5, July 29, 1922, pp. 106-108, 1 fig. Effect of temperature; calculation of masonry dams; examples.

Cataluna, Spain. Building the Highest Dam in Europe, Willis Ranney. Eng. News-Rec., vol. 89, no. 7, Aug. 17, 1922, pp. 260-267, 9 figs. Features of Camarasa hydroelectric development in Cataluna, Spain. Built at high speed under war conditions. Dam 333 ft. high with gravity section of sand-cement concrete.

Sukkur, India. The Sukkur Barrage. Engineer, vol. 134, no. 3478, Aug. 25, 1922, pp. 190-191, 3 figs. Details of proposed dam in province of Sind, India, which will hold up water to height of over 18 ft. by means of Stoney sluices; superstructure will be of masonry.

DIE CASTING

Aluminum Bronze. Aluminum-Bronze Die Castings. Machy. (Lond.), vol. 20, no. 509, June 29, 1922, pp. 377-380, 6 figs. Die-cast and sand-cast pieces compared. Metal, dies, and methods used in process.

Operations and Equipment. Die Casting in a Small Shop. Eng. Production, vol. 5, no. 97, Aug. 10, 1922, pp. 128-132, 8 figs. Operations and equipment.

DIELECTRICS

Corona in Air Spaces. Corona in Air Spaces in a Dielectric, J. E. Shrader. Am. Inst. Elec. Engrs., vol. 41, no. 9, Sept. 1922, pp. 702-709, 14 figs. Results of investigation of various materials both with air spaces excluded as much as possible and with air spaces of definite thickness, extent, and location at atmospheric pressure.

DIESEL ENGINES

Double-Acting Type. Design of Novel Diesel. Practical Engr., vol. 66, no. 1864, July 13, 1922, p. 26. Engine consists of two cylinders bolted together in middle and free to reciprocate relatively to covers.

Nordberg Small-Hp. Diesel Engine for Small Plants. Power, vol. 56, no. 5, Aug. 1, 1922, pp. 163-165, 6 figs. Discusses motives prompting Nordberg Mfg. Co. to design Diesel engines of small powers and describes important details of design.

DISTILLATION

Evaporation of. Evaporation and Distillation. Chem. Trade Jl., vol. 71, no. 1836, July 14, 1922, pp. 35-40. Abstract of papers on ammoniacal liquor stills, tar distillation, general problem of evaporation, and distillation of glycerine. Read before Soc. Chem. Industry.

DRILLING MACHINES

Drill Heads, Multi-Spindle. Adjustable Multi-Spindle Drill Heads. Eng. Production, vol. 5, no. 93, July 13, 1922, pp. 28-29, 4 figs. Description of drill head in which spindles can be adjusted for height so that when setting up it is not necessary for drills to be of equal length.

DROP FORGING

Methods. Drop Forging. Eng. Production, vol. 5, no. 98, Aug. 17, 1922, pp. 157-163, 21 figs. Methods, equipment and products of Thomas Smith's Stamping Works, Ltd., Coventry, England.

DRYDOCKS

Floating. A Reinforced Concrete Floating Dry Dock. Eng. and Contracting, vol. 58, no. 9, Aug. 30, 1922, p. 211, 1 fig. Describes 2000-ton drydock recently completed and launched by Cooperative Edilizia della Regione Gjilia at Trieste. From Génie Civil.

DRY KILNS

Lumber Piling. The Value of Drykiln Efficiency Tests. Wood-Worker, vol. 41, no. 6, Aug. 1922, pp. 39-40, 4 figs. Results of series of tests made by Vancouver Lumber Co., Ltd., Vancouver, B.C., to determine most efficient methods of piling lumber in dry kilns.

DURALUMIN

Properties and Methods of Using. Properties and Methods of Using Duralumin. Automotive Industries, vol. 47, no. 8, Aug. 24, 1922, pp. 370-376, 10 figs. This aluminum alloy has about same ultimate strength as structural steel but weighs one third as much; can be heat-treated, rolled, stamped, cast, forged, welded and readily machined; possesses characteristics which render it valuable to automotive industry.

E

ECONOMIZERS

Operation. Economizers and Economizer Operation, Frank H. Prouty. Power House, vol. 15, Aug. 5, 1922, pp. 25-26. Status in American practice. Progress in structural details. Modifications in soot-cleaning arrangements. Operating features.

EDUCATION, ENGINEERING

Petroleum Engineering. Petroleum Education, Edwin DeBarr and Fred W. Padgett. Chem. and Met. Eng., vol. 27, no. 3, July 19, 1922, pp. 125-127. Attempted outline of specialized courses for prospective graduates in petroleum engineering. Paper read before Am. Chem. Soc.

ELECTRIC CIRCUITS

Underground Construction. Underground Construction Suggestions, William S. Jones. Elec. World, vol. 80, no. 10, Sept. 2, 1922, pp. 481-485, 6 figs. Material specifications and installation requirements that can be applied to advantage where better or more elaborate standards have not been adopted.

ELECTRIC DRIVE

Metal Works. Electrification of the International Nickel Company's Works for Monel Metal, F. C. Watson. Assn. Iron and Steel Elec. Engrs., vol. 4, no. 9, Sept. 1922, pp. 415-454, 12 figs. Details of electric power-supply equipment of Huntington Works in West Virginia.

ELECTRIC GENERATORS

Capacity and Load. Relation Connected Loads Should Bear to Generator Capacity. Coal Age, vol. 21, no. 25, June 22, 1922, pp. 1037-1040, 13 figs. Fans have low demand factor and high power factor; pumps even in Illinois have low demand rate; locomotives on a run may use less than 40 per cent of their full duty. (Abstract) Paper read before joint meeting of Am. Inst. Elec. Engrs., West. Soc. of Engrs., Am. Inst. Min. and Met. Engrs., and Assn. Iron and Steel Elec. Engrs.

ELECTRIC GENERATORS, A.C.

45,000-Kv-a. Design of 45,000-Kv-a Generators, Queenston Plant, R. A. McCarty and H. U. Hart. Am. Inst. Elec. Engrs., vol. 41, no. 9, Sept. 1922, pp. 698-701, 6 figs. Deals with problems involved in design of armature winding, upper bearing bracket, and rotating spider. Gives tabulation of major dimensions and weights of generators.

Stator Windings. Probable Values of Conventional Allowance for A-C. Generators Stator Windings, F. D. Newbury. Am. Inst. Elec. Engrs. Jl., vol. 41, no. 9, Sept. 1922, pp. 636-645, 10 figs. Attempt is made to determine experimentally value of conventional allowance for described method of measurement when applied to given class of a.c. machine stator windings for given temperature limits.

ELECTRIC GENERATORS, D.C.

Parallel Operation. Parallel Operation of Commutating Pole Machines, C. B. Hathaway. Power Plant Eng., vol. 26, no. 17, Sept. 1, 1922, pp. 859-861, 10 figs. Review of principles involved in paralleling machines with particular reference to those of commutating-pole type.

ELECTRIC FURNACES

Acid. Notes on Acid Electric Furnace Practice, Charles W. Francis. Iron Age, vol. 110, no. 6, Aug. 10, 1922, pp. 345-346. Basic scrap and how to charge it; making a new bottom; when to tap and how to pour; alloy additions in furnace.

Basic. Notes on Basic Electric Furnace Operation, Charles W. Francis. Iron Age, vol. 110, no. 7, Aug. 17, 1922, pp. 421-422. Grade of lime necessary; reducing phosphorus and sulphur; high and low tap voltages.

Circulation of Molten Metal. The Circulation of Molten Metal by Means of Electrodynamic Forces, Oscar Brophy. Chem. and Met. Eng., vol. 27, no. 10, Sept. 6, 1922, p. 489, 1 fig. Discusses the three important electrodynamic forces that may be used to circulate molten metal, viz., pinch, effect, corner effect, and motor effect.

Foundries. Economy Features of Electric Foundry, Charles W. Francis. Iron Age, vol. 110, no. 5, Aug. 3, 1922, pp. 277-278. Locating furnace and supply bins; handling materials; caring for electrodes.

The Electric Furnace for the Foundry, Charles W. Francis. Iron Age, vol. 110, no. 4, July 27, 1922, pp. 201-202. Considerations in choosing proper unit for making steel castings. Place of acid and basic operations.

Induction. A New Induction Furnace, J. Murray Weed. Am. Electrochem. Soc. advance paper, no. 5, for meeting, Sept. 21-23, 1922, pp. 27-34, 3 figs. Describes induction furnace for melting non-ferrous metals, in which secondary consists of molten charge which is distinct from melting pot.

Induction Furnace for Melting Non-Ferrous Metals. Metal Industry (N.Y.), vol. 20, no. 8, Aug. 1922, pp. 312-313, 2 figs. New type developed by Gen. Elec. Co.

Smelting Pig Iron. Electric Smelting of Pig Iron in Sweden. Engineer, vol. 134, no. 3471, July 7, 1922, pp. 5-6, 4 figs. Describes Swedish electric furnace which is a combination of blast-furnace shaft with an electric hearth.

Steel. Costs of Electric Steel Melting, Charles Wellman Francis. Iron Age, vol. 110, no. 9, Aug. 31, 1922, pp. 525-526. Comparison of methods shows basic higher than acid; power charge, electrodes and labor chief controlling items.

Furnace Has Sealed Electrodes, G. Vitali. Iron Trade Rev., vol. 71, no. 9, Aug. 31, 1922, pp. 585-586, 2 figs. Units in electric steel plant of Fiat establishment in Italy embody radical changes in design of electrodes. Use 130-volt current for melting and 75-volt for refining operation. Translated from Stahl u. Eisen.

ELECTRIC LOCOMOTIVES

Design. Electric Locomotives, Vincent L. Raven. Electrician, vol. 89, no. 2304, July 14, 1922, pp. 36-38, 2 figs. Requirements for which any locomotive must be designed, the various designs which have been worked out to meet these requirements, and advantages and disadvantages of the various designs which have been completed. Paper read before Instn. Mech. Engrs. See also Ry. Engr., vol. 43, no. 510, July 1922, pp. 252-256, 2 figs.

Passenger, N.E. Ry. High Speed Electric Passenger Locomotive, North Eastern Railway. Ry. Engr., vol. 43, no. 511, Aug. 1922, pp. 296-297 and 313, 3 figs. Characteristics: Wheel arrangement, 4-6-4-; electric system, d.c.; voltage, 1500; overall length, 53 ft. 6 in.; overall width, 8 ft. 10 in.; driving wheel diam. 6 ft. 8 in.; rigid wheelbase, 16 ft.; weight, 102 tons; horse power, 1300; speed 51.5 m.p.h.

ELECTRIC METERS

Panelboards. Meter Panelboards for Large Consumers, Vernon I. E. Wiegand. Elec. World, vol. 80, no. 9, Aug. 26, 1922, pp. 415-417, 4 figs. Theft proof and fool-proof method of measuring simultaneous demands of primary customers at several substations and of metering power factor of two customers at same place.

ELECTRIC MOTORS

Circuits, Laying Out. Considerations in Laying Out Motor Circuits, Marin Phillips. Power, vol. 56, no. 9, Aug. 29, 1922, pp. 320-322, 1 fig. How to lay out and make a motor installation that is safe and reliable. Explains construction of motor panel board and gives tables for sizes of wires, switches, fuses and conduits.

Control. Electric Motor Control. Power Plant Eng., vol. 26, no. 16, Sept. 15, 1922, pp. 905-909, 8 figs. Various methods of starting and speed control of a.c. and d.c. motors.

ELECTRIC MOTORS, A.C.

Locating Faults. Locating and Repairing Alternating Current Motor Troubles, Marin Phillips. Power Plant Eng., vol. 26, no. 17, Sept. 1, 1922, pp. 856-858, 7 figs. Hints on practical methods of locating faults in induction motors.

ELECTRIC PLANTS

Development. Generating Station Development, David B. Rushmore and R. Pragst. Ass. Iron and Steel Elec. Engrs., vol. 4, no. 9, Sept. 1922, pp. 461-477, 7 figs. Reviews growth and development of generating stations, and discusses principle types of apparatus of which they are composed.

Performance Diagrams. The Operating Results of a Modern Power Station. Engineering, vol. 114, no. 2957, Sept. 1, 1922, pp. 270-272, 3 figs. Presents full set of diagrams relating to performance of Glasgow Corporation station at Dalmarnock over period of four consecutive weeks.

ELECTRIC RAILWAYS

Equipment N.Y., N.H. & H. New Single Phase Equipment for the New Haven, Walter H. Smith. Ry. Elec. Engr., vol. 13, no. 8, Aug. 1922, pp. 259-262, 8 figs. Dimensions and equipment of new motor cars, employing four 175-hp. Westinghouse-type 409-D single-phase, 25-cycle, series motors. Two master controllers installed in trail cars permit operation from any car in train.

Multiple-Unit Equipment. New Multiple-Unit Equipment for Long Island R.R., R.H. Freeland. Ry. Rev., vol. 71, no. 3, July 15, 1922, pp. 81-83, 3 figs. Improved Westinghouse control adds to desirability of multiple-unit system for suburban operation.

ELECTRIC TRANSMISSION LINES

Rebuilding. Rebuilding a Transmission System, J. P. Jollyman. Elec. World, vol. 80, no. 12, Sept. 16, 1922, pp. 599-603, 10 figs. Account of changes made in transmission system of Pacific Gas and Elec. Co.

220,000-Volt. The Purpose and Problems of 220,000-Volt Transmission, J. P. Jollyman. Jl. Elec. and West. Industry, vol. 49, no. 4, Aug. 15, 1922, pp. 131-133, 5 figs. Why transmission of energy at 220,000 volts was chosen for Pit River system by Pacific Gas and Elec. Co. Details of insulators, synchronous condensers, etc.

ELECTRICAL MACHINERY

Construction. The Present-Day Construction of Electrical Machinery, L. Fleishmann. Elecn., vol. 89, no. 2311, Sept. 1, 1922, pp. 236-239, 5 figs. Deals with waterwheel and turbo-generators; rotor construction; improvements in stator design; precautions with deep slots; parallel operation; heating problem; temperature distribution; starting synchronous and induction motors; variable-speed a.c. motors; rotary converters; d.c. machines; d.c. and a.c. traction motors; mercury rectifiers, transformers, etc. Translated from Elektrotechnische zeit,. vol. 42, p. 961, 1922.

ELECTRIC WELDING

Welding Car. Construction and Use of an Electric Welding Car (Construction et emploi d'un poste mobile de soudure électrique), Jacques Schopfer. Industrie des Tramways, vol. 16, no. 184, Apr. 1922, pp. 87-93, 10 figs. Construction and equipment of car which runs along street tracks and is used for welding worn street rails.

ELECTRIC WELDING, ARC

Locomotive Work. Use and Abuse in Electric Arc Welding in Locomotive Work, C. W. Roberts. Am. Welding Soc. Jl., vol. 1, no. 7, July 1922, pp. 9-19, 19 figs. General description and practical data.

ELECTRIC WELDING, RESISTANCE

Nomenclature. Terms Used in Electric Welding. Ry. Jl., vol. 28, no. 9, Sept. 1922, pp. 18-19. Nomenclature report made by resistance welding committee of Am. Bur. of Welding.

EMPLOYMENT MANAGEMENT

Employee Suggestion Plans. Employee Suggestion Plans. Sanford DeHart. Am. Mach., vol. 57, no. 10, Sept. 7, 1922, pp. 365-367. Reward for suggestions in money and promotion. How priority of suggestions is determined. Some successful plans in practice.

Personnel Records. Visualizing Potential Occupations, Ralph W Immel. Management Eng., vol. 3, no. 3, Sept. 1922, pp. 143-146, 2 figs. Describes and illustrates form of personnel record sheet.

ENGINEERING

Status of Profession. The Proper Status of the Engineering Profession, R. A. Hart. Chem. and Met. Eng., vol. 27, no. 6, Aug. 9, 1922, pp. 245-248. Sees forth ideals toward which individual engineers must strive, and examines critically shortcomings of present day engineer.

ENGINEERING SOCIETIES

Federated American Engineering Societies. A Lay View of the Function of the Federated American Engineering Societies. Min. and Metallurgy, no. 189, Sept. 1922, pp. [illegible] [illegible] entitled Science and Engineering of Prof. Cassius J. Keyser's work, Mathematical Philosophy.

ENGINEHOUSES

Turntables. Twin Span Turntable Reduces Load on Centre. Ry. Age. vol. 73, no. 9, Aug. 26, 1922, pp. 383-385, 5 figs. Describes turntable having two separate girder [illegible] centre [illegible] becomes largely independent [illegible] of circular rail.

EVAPORATION

Liquid to Gas. The [illegible] Gas, W. K. Lewis. Mech. Eng., vol. 44, no. 7, July 1922, pp. 445-446. Investigates mechanism of evaporation of liquid in [illegible] scrubbers, humidifiers, dehumidifiers, water coolers, air driers, etc. Establishes formula for calculating humidity of air from wet- and dry-bulb thermometer readings. (Abridgment.)

EXHAUST STEAM

Utilization. Exhaust-Steam Utilization (Abwärme-Verwertung), M. Hottinger. Schweizerische Bauzeitung, vol. 80, nos. 3, 4 and 5, July 15, 22 and 29, 1922, pp. 31-32, 37-41 and 52-54, 17 figs. July 15: Heat balance of a steam engine plant; diagrams and tables on steam consumption of turbines and piston engines. July 22: Utilization of waste and intermediary steam. July 29: Exhaust-steam utilization from steam hammers and similar arrangements.

EXPLOSIVES

Experimental Demonstrations. A Visit to the Plant of the Novel Industries, Ltd., at Ardeer, Scotland, Ellwood Hendrick. Chem. and Met. Eng., vol. 27, no. 7, Aug. 16, 1922, pp. 297-298, 2 figs. Three experiments showed difference between explosion caused by rapid burning and one due to rapid detonation. Demonstrations of properties and practical applications of explosives.

F

FEEDWATER HEATERS

Locomotive. Feed Water Heaters for Locomotives. Boiler Maker, vol. 22, no. 7, July 1922, pp. 196-197. Statistical data on use and tests of locomotive feed-water heaters. From report before Am. Ry. Assn.

Feed Water Heating and Boiler Circulating Apparatus for Locomotives. Ry. Gaz., vol. 37, no. 6, Aug. 11, 1922, pp. 198-202, 10 figs. Describes systems for heating boiler feedwater by flue gases and exhaust steam, either separately or in combination.

FELDSPAR

Quarries and Deposits. Feldspar Quarries and Deposits. Can. Min. Jl., vol. 43, no. 32, Aug. 11, 1922, pp. 518-523 and 527, 9 figs. Three articles: Richardson Feldspar Quarry, by J. C. Murray; Feldspar Deposits of the Ottawa District, by N. B. Davis; Storrington Feldspar Quarry.

FILTERS, SAND

Slow. Slow Sand Filtration Plant for Hartford, Conn., Caleb Mills Saville. Eng. News-Rec., vol. 89, no. 10, Sept. 7, 1922, pp. 380-384, 2 figs. Slow rather than rapid filters chosen after careful study in which color was chief mooted question. Costs compared with rapid filters at Cambridge.

FLAME PROPAGATION

Vapor-Air Mixtures. Limits for the Propagation of Flame in Vapour-Air Mixtures, Albert G. White. Chem. Soc. Jl., vol. 122, July 1922, pp. 1244-1270, 2 figs. Mixtures of air and one vapor at ordinary temperature and pressure.

FLOOD CONTROL

Problems. Flood Problems. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 5, May 1922, pp. 1092-1225 and (discussion) pp. 1226-1247, 43 figs. Symposium containing following papers: Flood Conditions in Canada, J. G. Sullivan. Floods on Small Streams Caused by Rainfall of Cloudburst Type, Gerard H. Matthes. Standing Waves in Rivers, Nathan C. Grover. Flood Problems in China, John R. Freeman. Flood Control of Mississippi River, J. A. Ockerson. Flood Problems in Arid Region, Arthur P. Davis. Some Factors Affecting Problem of Flood Control, C. E. Grunsky. Flood Control in the Miami Valley Ohio, Charles H. Paul. Missouri River Bank Protection at Omaha, Nebraska. Roy N. Towl.

FLOW OF FLUIDS

Condensation in Return Pipes. Theory for the Flow of Condensation in Return Pipes, R. V. Frost. Am. Soc. Heat and Vent. Engrs. Jl., vol. 28, no. 6, Sept. 1922, pp. 655-659 and (discussion) pp. 659-663. Factors affecting proportions of return pipes.

FLOW OF GASES

Venturi Tubes. Venturi Tubes and Orifices for Bulk Gas Measurement, Johnstone-Taylor. Am. Gas Jl., vol. 117, no. 7, Aug. 12, 1922, pp. 139-141 and 144, 4 figs. With special reference to British practice.

FLOW OF LIQUIDS

Cones. Liquids Flowing Through Cones, W. N. Bond. Physical Coc. of Lond. Proc., vol. 34, part 5, Aug. 15, 1922, pp. 187-196, 7 figs. Consideration of pressure gradient in liquid that flows through conical tube. Results of experiments.

Laminary and Turbulent. Investigations of Laminary and Turbulent Flow (Untersuchungen über laminare und turbulente Strömung), L. Schiller. Forschungsarbeiten auf dem Gebiete des Ingenieur-wesens, no. 248, 1922, 36 pp., 29 figs. Results of investigations carried out in Inst. for Applied Mechanics of University of Göttingen.

FLOW OF WATER

Channels. The Flow of Water in Open Channels (Ueber die Bewegung des Wassers in Offenen Gerinnen), Armin Schoklitsch. Schweizerische Bauzeitung, vol. 80, no. 5, July 29, 1922, pp. 47-50, 7 figs. Results of author's measurements of pulsations. Behavior of flowing water in vicinity of wall and on surface.

The Correlation of Momentum and Energy Changes in Steady Flow With Varying Velocity and the Application of the Former to Problems of Unsteady Flow or Surges, in Open Channels, Raymond D. Johnson. Engrs. and Eng., vol. 39, no. 7, July 1922, pp. 233-240, 9 figs.

FORGING

Header Machine. Header Machine Makes Forgings, H. E. Diller. Iron Trade Rev., vol. 71, no. 10, Sept. 7, 1922, pp. 643-645 and 650, 7 figs. Intricate parts formerly made on power hammer now are pressed into shape on an upsetting machine. Pole piece is forged in one operation and ring gear in three.

FOUNDATIONS

Concrete Stresses. Stresses in Concrete Foundations (Die Beanspruchungen in Betonfundamenten), W. Gehler. Bauingenieur, vol. 3, nos. 14 and 15, July 31 and Aug. 15, 1922, pp. 421-427 and 456-462, 23 figs. The sliding surfaces of concrete bodies are investigated and calculated with aid of the Mohr stress diagram. Based on model tests with concrete blocks, origin of cracks in structures is explained and safety measures are recommended.

Pressure Transmission through Soils. Transmission of Pressure through Solids and Soils and the Related Engineering Phenomena, George Paaswell. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 5, May 1922, pp. 1075-1089, 8 figs. It is shown that, in restricted sense, present-day rule-of-thumb methods of assumed stress paths hold true. Deals with two types of materials, namely, true granular, such as ordinary soils, and concrete aggregates, such as rock soils and concrete materials.

FOUNDRIES

Bronze. The Bronze Foundry (La Fonderie de Bronze), Derdinger. Fonderie Moderne, no. 7, July 1922, pp. 9-20 and (discussion) 21-24, 11 figs. Detailed discussion of organization of modern bronze foundry; layout, equipment, furnaces, sand, alloys, treatment of slag, illumination, etc.

FREIGHT HANDLING

Terminal. Terminal Relief by Direct Freight Delivery. Ry. Age, vol. 73, no. 12, Sept. 16, 1922, pp. 514-516. Successful system necessitates complete co-operation of railroad shipper and responsible trucking medium. Abstract of talks before Soc. Terminal Engrs.

Veri-Direct Method. The Veri-Direct Method of Loading, L.C.L. Freight, C. G. Johnson. Railroad Herald, vol. 26, no. 9, Aug. 1922, pp. 29-33. Also discusses veri-check record of handling inbound freight effective at larger stations on Ohio region of Erie Railroad.

FUELS

Colloidal. Colloidal Fuel, Lindon W. Bates. Steam, vol. 30, no. 2, Aug. 1922, pp. 41-44. Outline of nature of colloidal fuel and its relation to railway systems of United States.

Heating Values. Thermo-Calorimetric Heating values of Fuels, J. Hudler. Mech. Eng., vol. 44, no. 9, Sept. 1922, pp. 596-597, 3 figs. Author indicates method for determining heating value of fuels which he claims is superior to straight calorimeter method. Translated from Zeit. des Vereines deutscher Ingenieure, vol. 66, no. 20, May 20, 1922, pp. 495-497.

Refuse. Power from Refuse in Britain, C. H. S. Tupholme. Power Plant Eng., vol. 26, no. 17, Sept. 1, 1922, pp. 853-854. Producer gas made from factory and dust-bin used in gas engines and boiler furnaces.

Wood Waste, Gasification of. Utilization of Wood Refuse through Gasification (Verwertung der Holzabfälle durch Vergasung), Hans Neumann. Zeit. des Vereines deutscher Ingenieure, vol. 66, nos. 31-32, Aug. 12, 1922, pp. 757-763, 23 figs. Review of wood-gasification plants; the Deutzer double producer with tar-washing plant and practical results obtained therewith; wood-gasification plant of the Liusen Woxna Works. Relative economy of wood-burning furnaces and wood-gasification plants for power supply of saw mills with regard to waste-heat utilization, tar recovery and wood residue.

See also Pulverized Coal.

FURNACES, BOILER

Air Spraying of Fuel. Air-Spraying the Fuel. Practical Engr., vol. 66, no. 1848 July 27, 1922, pp. 52-53, 2 figs. Describes apparatus known as air-spray for ensuring complete combustion of fuel.

Plate Thickness. Chart for Boiler-furnace Plate Thickness, Arnold A. Arnold. Mech. World, vol. 72, no. 1859, Aug. 18, 1922, pp. 118-119, 2 figs. Presents chart based on formulas applicable to plain furnaces or boiler flues given in latest rules for boiler strengths issued by (Brit.) Board of Trade under title, Standard Conditions for the Design and Construction of Marine Boilers.

Volumetric Dimensions. The Volumetric Dimensions of Boiler Furnaces. Engineer, vol. 134, no. 3479, Sept. 1, 1922, pp. 217-218. Notes on large combustion chambers and use of pulverized fuel; question of furnace volume and boiler design.

FURNACES, HEATING

Continuous. Continuous Heating Furnaces for Steel, W. E. Groume-Grjimailo. Iron Age, vol. 110, no. 8, Apr. 24, 1922, pp. 465-467, 8 figs. Importance of careful attention to roof slope; flow of gases outlined to prevent uneven heating of ingots or billets. (Abstract.) From The Flow of Gases in Furnaces, Wiley & Co., translated by A. D. Williams.

Regenerative. Regeneratively Fired Heating Furnaces, W.-E. Groume-Grjimailo. Iron Age, vol. 110, no. 9, Aug. 31, 1922, pp. 537-538, 4 figs. Conditions necessary for freeing hearth of waste gases. Good and bad examples. Translated from The Flow of Gases in Furnaces, published by Wiley & Co.

FURNACES, METALLURGICAL

Heat Losses. Calculating Heat Losses in Furnaces, O. I. Hansen. Blast Furnace and Steel Plant, vol. 10, no. 8, Aug. 1922, pp. 437-440, 1 fig. New method for determination of heat losses due to incomplete combustion. Translated from Danish.

Types. Metallurgical Furnaces (Les Fours métalliques), Sigma. Métallurgie, vol. 54, nos. 11 and 12, Mar. 16 and 23, 1922, pp. 401-402 and 437-439. Mar. 16: Furnaces for solid, liquid and gaseous fuel; electric, blast, and reverberatory furnaces. Mar. 23: Recuperation in various types.

G

GAGES

Screw-Thread. Heat Treatment of Screw Gauges Eng. Production, vol. 5, no. 97, Aug. 10, 1922, p. 138. Résumé of experimental work conducted over period of nine months with view to determining best conditions for production of hardened screw gages to satisfy stringent tests of Nat. Physical Laboratory.

Some Notes on Hardening Various Screw Gauges, F. A. Livermore. Can. Machy., vol. 28, no. 2, July 13, 1922, pp. 26-27. Results of experimental work; effort to obtain process that will eliminate warpage and change of shape; methods of heat treating and quenching; expansion and contraction.

GALVANIZING

Heat Transmission. Heat Transmission in the Hot-Galvanizing Process—II, J. D. Keller. Blast Furnace and Steel Plant, vol. 10, no. 8, Aug. 1922, pp. 407-411, 4 figs. Describes temperature distribution of process.

GAS DISTRIBUTION

High-Pressure. High-Pressure-Gas-Distribution System of the Western United Gas and Electric Co., C. W. Melcher. Compressed Air Mag., vol. 27, no. 9, Sept. 1922, pp. 251-254, 4 figs. Details of system installed at Joliet, Ill.

GAS HOLDERS

Hamilton, Ont. Five million Foot Gas Holder, Hamilton, Ontario, H. E. Gingrich. Can. Engr., vol. 43, no. 8, Aug. 22, 1922, pp. 271-273, 2 figs. Recently completed structure for United Gas and Fuel Co. Ltd., 214 ft. in diameter, 192 ft. 4 in. high; water tank 32 ft. 4 in. deep holding, 8,655,040 gal.

GAS PRODUCERS

Ash-Fusion. An Ash-Fusion Producer, M. Rivière Gas Jl., vol. 159, no. 3093, Aug. 23, 1922, pp. 424-425, 1 fig. Describes Marconnet producer for gasification of coke breeze. Translated from paper read before Société Technique du Gaz.

Körting. The New Körting Gas Producers (Die neuen Körting-Gaserzeuger), H. Pradel. Wärme, vol. 45, no. 29, July 28, 1922, pp. 356-357, 4 figs. Details of two new types of producers for burning of low-grade fuel, for suction-gas operation, and with tar-recovery plant. One is revolving-grate type.

GAS TURBINES

Hepburn-Forbes System. The Internal Combustion Turbine, W. A. D. Forbes. Engineer, vol. 134, no. 3479, Sept. 1, 1922, pp. 224-225, 2 figs. Comparison of types and efficiencies. Description of new system of operation proposed by author and H. A. Hepburn, based on new theory of nozzle action and involving use of novel type of pump, known as kinetic compressor.

Problem. The Problem of the Internal Combustion Turbine. Mar. Engr. and Nav. Architect, vol. 45, no. 539, Aug. 1922, pp. 297-299, 1 fig. Comparison of temperature conditions in internal-combustion turbine and reciprocating engine. Internal-combustion turbine a possible economic intermediary between and Diesel engines.

GASOLINE

Synthetic. Progress in Synthetic-Gasoline Production, Roy Cross. Mech. Eng., vol. 44, no. 9, Sept. 1922, pp. 593-595 and 621, 3 figs. Particulars regarding processes employed. Results or tests of improved synthetic-crude system. Comparative costs of manufacturing gasoline by different processes. (Abridgment.)

GEAR CUTTING

Hobbing. Rapid Production of Gears by Hobbing Process. Can. Machy., vol. 28, no. 7, Aug. 17, 1922, pp. 26-27, 6 figs. Continuous cutting movement; one passage of hob completes gear; even distribution of generated heat; special arbors for different types of blanks; automatic indexing.

GEARS

Calculation. Calculation of Wheel Gears (Breechnung von Rädergetrieben), Rud. Böttger. Maschinenbau, vol. 1, no. 7, July 8, 1922, pp. 426-430, 7 figs. Equations are developed for calculation of pressure at pitch line of spiral gears.

Calculation of Tooth Wheels (Berechnung von Zahnrädern). Zeit. für die gesamte Giessereipraxis, vol. 43, nos. 28 and 29, July 22 and 29, 1922, pp. 391-393 and 408-409, 4 figs. Dimensions of teeth and their parts, and of wheels. Calculations.

Helical and Spur. Helical Gears and Spur Gears — III, W. G. Dunkley. Machy. (Lond.), vol. 20, no. 515, Aug. 10, 1922, pp. 578-580, 8 figs. Load variation of spur gears compared with helical gears; relative variation in periodical velocity transmission; conditions affecting relative efficiencies; effect of tooth inaccuracies.

Long-Addendum. Lewis Constants Determined for Long Addendum Gears, P. M. Heldt. Automotive Industries, vol. 47, no. 5, Aug. 3, 1922, pp. 219-221, 5 figs. Method of obtaining value of constants for full-strength formula. Long addendum principle of value only in large reduction sets.

Methods of Forming Teeth. Different Methods of Forming Gear Teeth Profiles, C. B. Hamilton, Jr., Can. Machy., vol. 27, no. 21, May 25, 1922, pp. 23-24. Grinding process seldom used except for worms; producing thin gears in punch press; classification according to tooth shape; involute system in general practice.

Pump, Tooth Shapes. Tooth Shapes for Pump Gears, A. Fisher. Machy. (Lond.), vol. 20, no. 517, Aug. 24, 1922, pp. 633-634, 5 figs. Features of design to secure increased capacity.

Teeth, Chamfering Machine. A Gear Tooth Chamfering Machine. Eng. Production, vol. 5, no. 100, Aug. 31, 1922, pp. 194-195, 6 figs. Details of Parkinson machine which deals with gears up to 15-in. diameter by 5 diametral pitch and can mill single or double chamfer.

GOLD DEPOSITS

British Columbia. The Gold-Quartz Veins of Bridge River District, B.C., and Their Relationship to Similar Ore-Deposits in the Western Cordilleras, W. S. McCann. Economic Geology, vol. 17, no. 5, Aug. 1922, pp. 350-369, 4 figs. Describes gold-quartz deposits of region and their resemblance to those of Southeastern Alaska and Grass Valley, Cal.

GRINDING

Iron and Steel. Investigates Grinding of Steel, H. W. Wagner. Iron Trade Rev., vol. 71, no. 7, Aug. 17, 1922, pp. 444-446, 2 figs. Tests show effects of heat and mechanical treatment and chemical composition of iron and steel on grinding-wheel action. Finds manganese steel grinds readily when forced despite toughness.

Small-Tool Industry. Grinding in the Small Tool Industry. Machy. (N.Y.), vol. 29, no. 1, Sept. 1922, pp. 45-51, 19 figs. Grinding straightedges; sharpening cutters; grinding plug gages, micrometer parts, twist drills, taps and dies, lathe and planer tools.

GYPSUM

Specifications. Report of Committee C-II on Gypsum. Am. Soc. for Testing Matls. advance paper for meeting June 26-30, 1922, 11 pp. Proposed revised tentative specifications for gypsum wall board, gypsum plaster board, and definitions of terms relating to gypsum industry.

H

HANDLING MATERIALS

Iron and Steel Industry. Material-Handling Equipment as Used in the Iron and Steel Industry, F. L. Leach. Mech. Engr., vol. 44, no. 8, Aug. 1922, pp. 493-499, 14 figs. Describes handling machinery and apparatus used in manufacture of steel. (Abstract.)

Rotary Tank Cars. Handling Bulk Materials of Various Kinds by Compressed Air and Rotary Tank Cars Rudolph Weleker. Compressed Air Mag., vol. 27, no. 8, Aug. 1922, pp. 230-232, 3 figs. Design of rotary tank car. Detail of methods of loading and discharge.

HARBOR IMPROVEMENTS

NEW ENGLAND COAST. Shore Protection and Harbor Development Work on the New England Coast, Frank W. Hodgdon. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 6, Aug. 1922, pp. 1429-1434 and discussion pp. 1439-1449. Review of work done to prevent further erosion.

HARMONIC ANALYSIS

WAVE FORMS. Harmonic Analysis by Selected Co-Ordinates, Albert E. Clayton. Elecn., vol. 89, no. 2309, Aug. 18, 1922, pp. 176-179, 6 figs. New form of schedule for analysis of wave forms.

HEAT

CONDUCTIVITY. The Derivation of True Thermal Conductivity Coefficient from Overall Test Results, P. Nicholls. Am. Soc. Heat and Vent. Engrs. Jl., vol. 28, no. 6, Sept. 1922, pp. 665-677 and discussion pp. 677-682, 8 figs. Method is developed for deriving curve of conductivity coefficient against temperature. Report of cooperative work of this Society and U. S. Bur. of Mines Experiment Station, Pittsburgh.

HEAT PUMPS

PROCESS AND APPLICATIONS. The Heat Pump, T. B. Morley. Engineer, vol. 134, no. 3472, July 14, 1922, pp. 27-29, 5 figs. In heat-pump process vapor from evaporator is taken to a compressor, in which its pressure, and thence also its temperature are raised to such a degree that the compressed vapor may serve as heating medium in evaporator. Details and application of heat pump.

HEAT TRANSMISSION

BUILDINGS, MEASURING FLOW IN. Measuring the Flow of Heat in Buildings By Means of Resistance Wires, F. E. Giesecke. Heat and Vent. Mag., Vol. 19, no. 8, Aug. 1922, pp. 29-31, 5 figs. Account of tests made in cold-storage building of Lone Star Ice Co., Austin, Tex.

HEATING AND VENTILATING

DETROIT JUNIOR HIGH SCHOOL. Mechanical Equipment of the Intermediate or Junior High School in Detroit, H. W. Anderson. Heat and Vent. Mag., vol. 19, no. 7, July 1922, pp. 38-43, 9 figs. Details of "projection" method of air distribution, with ceiling fresh air outlets, as adopted in Barbour schools. From paper and before Am. Soc. Heat and Vent. Engr.

HEATING, HOT-WATER

STEAM-JET APPARATUS. Investigations of Steam-Jet Apparatus (Untersuchungen an Dampfstrahlapparaten), F. Heinl. Forschungsarbeiten auf dem Gebiete des Ingenieurwesens, no. 256, 1922, 23 pp., 21 figs. Investigations to determine following questions; degree of water heating obtained under most favourable working conditions with given steam-supply conditions and discharge pressure; behavior of steam-jet apparatus with change of their normal water volume.

HEATING, STEAM

EXHAUST STEAM FOR. Recent Data on Exhaust Steam for Heating. Heat. and Vent. Mag., vol. 19, no. 7, July 1922, pp. 35-38, 17 figs. Records of operation in office buildings and hotels in New York City made basis of new coal consumption charts.

HELICOPTERS

THEORY. The Problem of the Helicopter, Edward P. Warner. Nat. Advisory Committee for Aeronautics Technical Notes, no. 4, May 1920, 18 pp., 2 figs. and 2 blue prints. Theory of direct-lefting screw propeller; safety of helicopters in forced descents; horizontal travel; stability and control of helicopter; results of tests.

HIGHWAYS

DESIGN, CONSTRUCTION AND MAINTENANCE. The Design, Construction and Maintenance of Highways in Relation to the Development of Mechanically Propelled Vehicular Traffic, C. H. Bressey. Inst. of Transport Jl., vol. 3, no. 5, July 1922, pp. 348-357 and (discussion) 357-368.

HYDRAULIC TURBINES

DESIGN. The Hydraulic Turbine in Evolution, H. Birchard Taylor and Lewis F. Moody. Engrs. and Eng., vol. 39, no. 7, July 1922, pp. 241-259, 15 figs. Problems created by turbine evolution; some mechanical and hydraulic problems in design of high-speed turbines; efficiencies attained in turbines now developed; analysis of flow in high-speed turbines; influence of turbine speed on setting and station structure.

MANITOBA POWER CO. Turbines for the Great Falls Development of the Manitoba Power Company, H. S. VanPatter. Eng. Jl., (Eng. Inst. Can.), vol. 5, no. 9, Sept. 1922, pp. 461-464, 5 figs. Special features of 28,000-hp. I. P. Morris turbines installed in this plant.

WATER ADMISSION WITH SHOCK. Loss Caused by Shock with Admission of Water in Turbine Blade (Der "Stossverlust" des Wassers beim Eintritt in Schaufelsysteme, D. Thoma. Schweizerische Bauzeitung, vol. 80, no. 8, Aug. 19, 1922, pp. 83-84, 4 figs. Formula is derived for calculation of loss of hydraulic [illegible] head.

HYDROELECTRIC DEVELOPMENTS

CAMERON FALLS, CANADA. Hydro-Electric Development at Cameron Falls, Nipigon River, Ontario. Elec, News, vol. 31, no. 15, Aug. 1, 1922, pp. 40-44, 10 figs. Power House and electrical equipment. First two units of ultimate capacity totaling 75,000 hp. installed. See also Contract Rec., vol. 36, no. 31, Aug. 2, 1922, pp. [illegible]

ECONOMICS. Economics of Water-Power Development, Curtis A. Mees. Mech. [illegible] Discusses production, main[illegible] hazard and unrecoverable losses.

QUEENSTON-CHIPPAWA, CANADA. Queenston-Chippawa Power Development. Engr and Eng., vol. 39, no. 8, Aug. 1922, pp. 292-301, 8 figs. Article on general and [illegible] features by Edgar T. J. Brandon.

HYDROELECTRIC PLANTS

CANADA. Nipigon Hydro-Electric Power Development. Can. Engr., vol. 43, [illegible] plant at Cameron Falls [illegible]

DESIGN. Hydroelectric Power-Plant Design, J. A. Sirnit. Mech. Engr., vol. 44, no. 8, Aug. 1922, pp. 505-508, 8 figs. Describes Thurlow backwater suppressor utilizing waste water for removal of high tail water from discharge opening during flood periods. Describes two testing models and design of draft-tube orifice. Details of construction and equipment of plant of Ala. Power Co. at Mitchell Dam, Ala.

HAZARDS. Hazards in Hydroelectric Plants, Alex. E. Bauhan. Gen. Elec. Rev., vol. 25, no. 9, 1922, pp. 526-537, 10 figs. Some hydraulic and mechanical hazards present in operation of low-head hydroelectric plant and precautions which may be taken to avoid them.

QUEENSTON-CHIPPAWA, Canada. Queenston-Chippawa Development. Power Plant Eng., vol. 26, no. 15, Aug. 1, 1922, pp. 760-767, 12 figs. General description including generator units and accessories.

The Queenston-Chippawa 600,000-Hp. Hydro-Electric Station. Power, vol. 56, no. 8, Aug. 22, 1922, pp. 270-278, 19 figs. Describes headworks, penstocks, power house and electrical equipment.

WINNIPEG, CAN. Extensions to the Hydro-Electric System of the City of Winnipeg E. V. Caton. Eng. Jl., (Eng. Inst. Can.), vol. 5, no. 9, Sept. 1922, pp. 441-444, 4 figs. Additional units installed in Point du Bois, plant, on Winnipeg River.

I

IMPACT TESTING

DEVELOPMENT. Symposium on Impact Testing of Materials. Am. Soc. for Testing Matls. advance paper for meeting June 26-30, 1922, 107 pp., 34 figs. Review of development of impact testing of materials and discussion of significance and value of impact test.

INDUSTRIAL MANAGEMENT

BEDAUX METHODS. Application of Bedaux Management Methods in the Robbins & Myers Plants, L. C. Morrow. Am. Mach., vol. 57, nos. 7 and 8, Aug. 17 and 24, 1922, pp. 249-255 and 294-298, 12 figs. Aug. 17: Estimating, manufacturing, inspection and salvage; reports and graphs. Aug. 24: Time studies; premium for inspection; reports and graphs.

PLANNING DEPARTMENT. Practical Work Planning, G. M. Bryceson. Eng. Production, vol. 5, no. 100, Aug. 31, 1922, pp. 206-209, 7 figs. System for determining and recording machine-hour capacity of each department and subdividing this into machine-hour capacity for each type of machine in the various sections.

PRODUCTION RECORDS. Records as a Basis for Management, B. A. Franklin. Management Eng., vol. 3, no. 3, Sept. 1922, pp. 133-137. Discusses task of executive; pictures of costs, prices and profits; specifications for a record; standards or measuring rules; scope of records; records of information and control.

INDUSTRIAL ORGANIZATION

PUBLIC OFFICE. Organizing a Public Office to Conduct a $20,000,000 Building Program, Norris M. Perris. Management Eng., vol. 3, no. 3, Sept. 1922, pp. 147-153, 1 fig. It is claimed that saving of $30,000 in a $330,000 pay-roll was made in one year by increasing quantity production, and salaries were increased 25 per cent. Presents plan of new organization.

INDUSTRIAL RELATIONS

DELCO POLICY. An Industrial Relations Policy that Makes Production Cost Less, Harry Tipper. Automotive Industries, vol. 47, no. 10, Sept. 7, 1922, pp. 473-476, 2 figs. Practice of Dayton Eng. Laboratories Co. Personal grievances are constructively met by interview and adjustment. Social activities encouraged, but operated entirely by employees. Small items and trifles considered important.

INDUSTRIAL TRUCKS

GAS-OPERATED. A Gas-Operated Industrial Truck with Elevating Platform, Ry. Age, vol. 73, no. 6, Aug. 5, 1922, p. 263, 2 figs. Has platform 54 in. by 26 in. with 11 in. minimum height above floor, which can be raised to 16 in. by lifting mechanism.

INSULATING MATERIALS

THERMAL CONDUCTIVITY. Measurement of The Thermal Conductivity of Liquids, Insulating Materials and Metals (Messung des Wärmeleitvermögens von Flüssigkeiten, Isolierstoffen und Metallen), Max Jakob. Zeit. des Vereines deutscher Ingenieure, vol. 66, no. 27, July 8, 1922, pp. 688-693, 4 figs. Measurements on liquids and poor heat conductors (solid); and on metals and alloys.

INTERCHANGEABLE MANUFACTURE

INSPECTION. Control of Quantity Production (Vérification d'une fabrication de pièces en grande série), Danty-Lafrance. Vie Technique et Industrielle, vol. 3, nos. 33 and 34, June and July 1922, pp. 154-158 and 245-248, 7 figs. Necessity for rigid control and inspection in manufacture of interchangeable parts; tolerances allowable; inspection of general forms and threads; control of work done by inspecting staff.

INTERNAL-COMBUSTION ENGINES

COMPOUND. Compound the Combustion Engine, Mech. Eng., vol. 44, no. 8, Aug. 1922, pp. 525-527 and 554, 1 fig. Discussion of paper by Elmer A. Sperry, presented before A.S.M.E.

FRICTIONAL LOSSES. A New Method for Determining Engine Friction Losses Automotive Industries, vol. 47, no. 8, Aug. 24, 1922, p. 369. Method developed by G. Lumet based on idea that friction couple varies with engine torque and consequently with mean effective pressure.

FUEL DETONATION. Detonation Characteristics of Blends of Aromatic and Paraffin Hydrocarbons, Thos. Midgley, Jr., and T. A. Boyd. Jl. Indus. and Eng. Chem., vol. 14, no. 7, July 1922, pp. 589-593, 3 figs. Results obtained in careful measurement of effects of various concentrations of benzene, toluene, or xylene upon detonation tendency of paraffin fuels in badly carbonized or high compression engines.

IGNITION. See *Ignition*.

STEEL-PLANT POWER GENERATION. Internal Combustion Engines for Power Generation in Steel Plants, D. M. Petty. Assn. Iron and Steel Elec. Engrs., vol. 4, no. 9. Sept. 1922, pp. 569-571, 5 figs. Describes 4-cylinder, 4 cycle double-acting gas engine and 4.6 or 8-cylinder, 2 cycle Diesel oil engine. Analysis of first cost and cost of operation.

IRON

Rustproofing. The Rustproofing of Iron (Wesen und Ziele des Eisenschutzes), Leo Ivanovsky. Eisenbau, vol. 13, no. 7, July 25, 1922, pp. 153-162. With special consideration of so-called self-protection of iron, that is, treatment of iron in its natural state so as to render it rustproof.

IRON ALLOYS

Iron-Carbon. Conditions of Stable Equilibrium in Iron-Carbon Alloys, H. A. Schwartz, H. R. Payne, A. F. Gorton and M. M. Austin. Am. Inst. Min. & Met. Engrs. Trans., no. 1181-S, Aug. 1922, 12 pp., 6 figs. and abstract in Min. & Metallurgy, no. 188, Aug. 1922, pp. 38-39, 1 fig. Study of Single, impure, iron-carbon alloy carried out in Research Laboratory of Nat. Malleable Castings Co.

IRON CASTINGS

Casting Without Feeding Heads. British Opinions on Making Castings without Feeding Heads. Foundry Trade Jl., vol. 26, no. 313, Aug. 17, 1922, pp. 136-139. Discussion of E. Ronceray's paper published in same journal, June 1.

Making Castings without Feeding Heads, S. G. Smith. Foundry Trade Jl., vol. 26, no. 313, Aug. 17, 1922, pp. 140-141, 1 fig. Refers to paper by E. Ronceray published in same journal, June 1, and discusses possibility of partially or wholly dispensing with feeders, feeding heads and dross heads.

IRON, ORE

Canada. Canada's Iron Ore Problem, G. C. MacKenzie. Can. Min. Jl., vol. 43, no. 30, July 28, 1922, pp. 482-485. Beneficiation of Ontario iron ores including conversion of hematite to magnetite, metalizing iron ores, electric smelting, smelting of titaniferous magnetite.

IRRIGATION

British Columbia. Irrigation in British Columbia, Ernest A. Cleveland. Eng. Jl. (Eng. Inst. Can.), vol. 5, no. 8, Aug. 1922, pp. 417-422 and (discussion) p. 423. Review of irrigation in Province from earliest undertaking to present extensive systems.

J

JIGS

Manufacture. Some Small Jigs. Engineer, vol. 133, no. 3464, May 19, 1922, pp. 542-545, 12 figs. Methods employed in small tool works of C. A. Vandervell & Co., Brighton, England.

L

LATHES

Auto-Lathes. Reducing Costs on Chucking Work, A. H. Lloyd. Eng. Production, vol. 5, no. 93, July 13, 1922, pp. 26-27, 5 figs. Auto-lathes and their tool equipment.

Driving-Wheel. Driving Wheel Lathe Tests, G. T. R., Stratford Shops. Can. Ry. & Mar. World, no. 294, Aug. 1922, p. 422, 1 fig. Data of tests at Grand Trunk shops, Stratford, Ont., of 90-in. heavy driving wheel lathe. Results given in form of table.

LEAD

Smelting. Lead Smelting Practice at Trail, J. Buchanan. Can. Min. Jl., vol. 43, no. 32, Aug. 11, 1922, pp. 531-533. Evolution of double sintering; sintering of fine materials; improving friable sinter; hood and hanging charges; recent metallurgical innovations.

LIGHTING

Street. Improved Street Lighting That Assures Greater Safety to Traffic, Earl A. Anderson and O. F. Haas. Elec. World, vol. 80, no. 5, July 29, 1922, pp. 221-224, 5 figs. Nature of fixtures employed and illumination produced in East Cleveland, Ohio. Both series and multiple circuits adopted.

LIGNITES

Importance to British Empire. Lignites and Brown Coals and their Importance to the British Empire, William A. Bone. Combustion, vol. 7, no. 3, Sept. 1922, pp. 138-146, 1 fig. Address before Roy Soc. of Arts.

LIME

Specifications. Report of Committee C-7 on Lime. Am. Soc. for Testing Matls., advance paper for meeting June 26-30, 1922, 29 pp., 1 fig. Proposed tentative definitions of terms relating to lime; methods of sampling, inspection, packing and marking lime and lime products; determination for available lime in quicklime and hydrated lime; specifications for quicklime and hydrated lime for structural purposes, manufacture of paper, sulfite pulp, varnish; use in textile industry, and manufacture of silica brick.

LIQUID AIR

Manufacture and Applications. Liquid Air. Its Manufacture and Applications. Chem. Trade Jl. & Chem. Engr., vol. 71, nos. 1839 and 1840, Aug. 18 and 25, 1922, pp. 189-191 and 221-223, 1 fig. Aug. 18: Theoretical considerations; properties of liquid air; manufacturing methods. Aug. 25: Production of oxygen and nitrogen, argon, helium, neon, and hydrogen; liquid air in explosives manufacture; recent uses.

LOCOMOTIVE BOILERS

Design and Maintenance. Design and Maintenance of Locomotive Boilers. Ry. Age (Daily), vol. 72, no. 24e, June 22, 1922, pp. 1687-1690 and (discussion) 1690-1696, 4 figs. Comparison of radial stay and Belpaire types of construction; investigation of dry pipe situation. A. R. A. Mech. Div. Committee recommendations.

Design and Maintenance of Locomotive Boilers, Boiler Maker, vol. 22, no. 8, Aug. 1922, pp. 223-226, 3 figs. Comparison of radial stay and Belpaire types. Report read before Am. Ry. Assn.

Mountain-Type Locomotives. Boiler of Union Pacific Mountain Type Locomotive. Boiler Maker, vol. 22, no. 8, Aug. 1922, pp. 217-222, 9 figs. High boiler capacity obtained in 4-8-2 locomotive which is lightest per unit of power ever built.

LOCOMOTIVES

Accessories. New Locomotive Specialties Developed on the Union Pacific. Ry. Rev., vol. 71, no. 3, July 15, 1922, pp. 73-76, 5 figs. Fuller low-water alarm; Fetters drifting valve for superheater locomotives; outside joint for maintaining air-tight joint at intersection of outside steam pipe and smoke box.

Booster. Dynamometer Tests of the Locomotive Booster. Ry. Age, vol. 73, no. 12, Sept. 16, 1922, pp. 511-514, 8 figs. Describes booster tested, and test equipment. Severe tests demonstrate reliability at heavy loads and high speeds; maximum drawbar pull 11,000 lb.

Booster for Tender Trucks Developed on D. & H. Ry. Age, vol. 73, no. 4, July 22, 1922, pp. 145-147, 6 figs. Utilization of excess boiler capacity and weight of tender as sources of revenue tractive power.

Electric. See *Electric Locomotives*.

Fireless. Fireless Locomotives. Times Trade & Eng. Supp., vol. 10, no. 215, Aug. 19, 1922, p. 465, 2 figs. Osmotic storage of energy. Refers to apparatus invented by Honigmann about 40 years ago, and recent improvement in arrangement proposed by Dr. Schreber. Boilers described might be used in passenger steamers over short distances or for driving of single cars on railway lines with light traffic.

Gasoline Switching. Gasoline Switching Locomotive with Hydraulic Drive. Ry. Age, vol. 73, no. 8, Aug. 19, 1922, pp. 323-326, 7 figs. Universal oil transmission governs speed and direction and gives remarkable flexibility of control.

Internal-Combustion. A French Petrol Locomotive. Engineer, vol. 133, no. 3461, Apr. 28, 1922, p. 476, 2 figs. Details of Renault 19-ton gasoline locomotive. Translated from Génie Civil.

Rod Testing. How Locomotive Rods are Tested and Machined at Lima. Ry. Rev., vol. 71, no. 8, Aug. 19, 1922, pp. 231-234, 6 figs. New testing machine eliminates defective rods and use of special jigs insures uniform dimensions.

Steam-Turbine. Turbine Locomotives (La locomotive à turbines), J. Netter. Nature, no. 2514, June 10, 1922, pp. 365-367, 4 figs. Describes type manufactured in 1914 in Milan, and another type made by Escher Wiss & Co., Zurich, Switzerland, with special tender for necessary cooling apparatus for condenser.

The Ljungström Turbine Locomotive. Engineering, vol. 114, nos. 2951, 2953, 2954 and 2955. July 21, Aug. 4, 11 and 18, 1922, pp. 64-70, 26 figs.; 131-133, 29 figs. partly on supp. plate; 163-168, 27 figs. and 198-203, 19 figs. Motive power is condensing steam turbine developing 1800 hp. which drives 3 pairs of coupled wheels by means of double-reduction gearing. Forced lubrication to all working parts.

Switching. Petrol Shunting Locomotive at Kelso, North British Railway. Ry. Gaz., vol. 37, no. 1, July 7, 1922, p. 17, 3 figs. Description of four-wheeled locomotive with 40 b.hp. engine with roller chains to axle.

Works. The Locomotive Works of Sir W. G. Armstrong Whitworth & Co., Ltd. Eng. Production, vol. 5, nos. 93 and 94, July 13 and 20, 1922, pp. 31-36 and 61-65, 21 figs. Description of plant and working methods.

LUBRICATING OILS

Storing and Clarifying. Storing and Clarifying Oil in Shops. Am. Mach., vol. 57, no. 4, July 27, 1922, pp. 125-127. Methods used in 12 well-known plants. Tanks, separators, mixtures and other details.

Wax Extraction. Wax Extraction by Centrifugal Force. Oil & Gas Jl., vol. 21, no. 7, July 13, 1922, pp. 14 and 92-93, 3 figs. Separating wax crystals from lubricating oils; latest developments by Maryland Refining Co.

LUBRICATION

Tests. Lubrication Tests, H. T. Newbigin. Engineering, vol. 114, no. 2957, Sept. 1, 1922, pp. 260-261, 7 figs. Describes tests made with segmental, pivoted blocks or pads, of Mitchell type, running against a plane surface thereby providing mechanical conditions necessary for formation of true-pressure oil films.

M

MACHINE-TOOL INDUSTRY

Sweden. The Machine Tool Industry in Sweden. Machy. (N.Y.), vol. 29, no. 1, Sept. 1922, pp. 31-32. Notes on leading machine-tool building plants and their products.

MACHINE TOOLS

Design and Manufacture. Machine Tools; Their Design and Manufacture, Joseph Horner. Engineering, vol. 114, no. 2956, Aug. 25, 1922, pp. 231-233. Notes on increased complication of machine tools; changing aspects of tooling; problem of increased output; automatic movements; materials; manufacture; jigs; tolerances, interchangeability; shop drawings; etc.

MALLEABLE CASTINGS

Manufacture. Making Malleable Castings, Enrique Touceda. Foundry, vol. 50, nos. 14, 15 and 16, July 15, Aug. 1 and 15, 1922, pp. 583-593, 622-626 and 676-680, 16 figs. July 15: Suggestions covering principles governing layout of American malleable foundry; how air furnaces are designed; suggestions for bungs and grades. Aug. 1: Metallurgical problems encountered in melting; finishing castings. Aug. 15: Tests showing effect of size of grates in distribution of metal; causes of picture-frame structure. (Abstract.) Paper read before Inst. Brit. Foundrymen.

MALLEABLE IRON

Advantages. Malleable Cast Iron, Enrique Touceda. Am. Mach., vol. 57, no. 9, Aug. 31, 1922, pp. 321-325, 7 figs. Poor qualities of pure cast iron; factors that make malleable cast iron superior; soundness, strength and good machineability attained.

METAL SPRAYING

Schoop Process. Protective Coatings of Sprayed Metal, Robert G. Skerrett. Iron Age, vol. 110, no. 5, Aug. 3, 1922, pp. 286-287, 2 figs. Late developments with Schoop process abroad; examples of applications and operating features; spraying pistol operated electrically. Article, based on European information, does not refer to developments of Schoop process in United States.

METALLOGRAPHY

Institute, Sweden. The Metallographical Institute (Metallografiska institutet), Carl Benedicks. Jernkontorets Annaler, vol. 106, no. 6, 1922, pp. 203-220, 7 figs. Description of institute, its buildings, departments and equipment; review of its work.

MICROSCOPIC, MACROGRAPHY AND. Recent Progress in Microscopic Metallography and Macrography (Les récents progrès de la Métallographie microscopique et de la macrographie), Léon Guillet. Revue Universelle des Mines, vol. 14, no. 1, July 1, 1922, pp. 1-17 (Metallurgical Section). Methods of microscopic metallography and macrography; examination and preparation of photographs; requirements of apparatus; results obtained.

METALS

ACID-RESISTING. Acid-Resisting Metals and Alloys, George A. Drysdale. Mech. Eng., vol. 44, no. 9, Sept. 1922, pp. 579-580 and 621. Account of research work carried out on various non-ferrous metals and alloys, with especial reference to their use in manufacture of mine pumps and chemical apparatus.

FATIGUE OF. Fatigue or Progressive Failure of Metals under Repeated Stress, H. F. Moore, J. B. Kommers and T. M. Jasper. Am. Soc. for Testing Matls. advance paper for meeting June 26-30, 1922, 23 pp., 21 figs. Discusses testing practice used in making repeated-stress tests, with especial reference to testing machines, test specimens and methods used in joint investigation of fatigue of metals now in progress. Recent test results are presented.

Fatigue of Metals, C. F. Stromeyer. S. Wales Inst. Engrs. Proc., vol. 38, no. 3, July 20, 1922, pp. 285-308 and (discussion) pp. 308-331, 2 figs. Description of fatigue-testing machine and results of tests.

HEAT-TEMPERATURE CURVES. Heat-Temperature Curves of Metals, Joseph F. Shagden. Iron Age, vol. 110, no. 4, July 27, 1922, pp. 218-222, 5 figs. Basis for average and instantaneous specific heat values provided by German laboratory tests. New specific heats for molten metal.

PROPERTIES. Deformation and Rupture of Solids (Déformation et rupture des solides), Mesnager. Revue de Métallurgie, vol. 19, nos. 6 and 7, June and July 1922, pp. 365-378 and 425-436, 37 figs. June: Elastic limit of mild steel and copper and experiments made in this connection. July: Rupture of fragile solids; difference between permanent deformation and rupture; experiments made by Dr. Karman at Göttingen on resistance of materials.

TEARING TESTS. Tearing Tests on Metals, Henry L. Heathecote and C. G. Whinfrey. Chem. & Met. Eng., vol. 27, no. 7, Aug. 16, 1922, pp. 310-311, 2 figs. Methods and results of testing metals for resistance to tearing.

TENSILE STRENGTH. Tensile Strength of Plastic Metals, Friedrich Koerber. Mech. Eng., vol. 44, no. 6, June 1922, pp. 392-393, 2 figs. Presents method for computing tensile strength of metals from curve of "true" stresses; discusses mechanism of tensile rupture test and proposes theory of tensile stresses based on assumption of slip and torsion effects of crystalline elements in metal. Translated from Stahl u. Eisen, vol. 42, no. 10, Mar. 9, 1922, pp. 365-370.

X-RAY INVESTIGATION. X-Ray Investigations on Metals, R. Glockner. Iron & Coal Trades Rev., vol. 105, no. 2841, Aug. 11, 1922, p. 186, 2 figs. Suggestions based on writer's own work and work by other investigators. Translated from Stahl u. Eisen.

MILLING CUTTERS

HELICAL. Construction of Milling Cutters. Practical Engr., vol. 66, no. 1846, July 13, 1922, p. 19, 1 fig. Describes Kendal & Gent cutter, a steel forging in which plain helical grooves are milled; blades are bent in special machine.

MINE RESCUE APPARATUS

ROTHERHAM. The "Rotherham" Rescue Apparatus, E. C. Elliston. Colliery Guardian, vol. 124, no. 3215, Aug. 11, 1922, pp. 329-330, 4 figs. Describes first liquid-air apparatus to be approved by (Brit.) Mines Dept. of Board of Trade. Consists of liquid-air container work on back, breathing bag worn in front, two short flexible rubber tubes, exhaust valve and purifier.

MOLDING METHODS

INGOT MOLDS. Molding and Casting of Ingot Molds (Formen und Giessen von Blockformen), Carl Irresberger. Stahl u. Eisen, vol. 42, nos. 17 and 26, Apr. 27, and June 29, 1922, pp. 649-654 and 1013-1016, 29 figs. Apr. 27: Describes Kunze method adopted some 12 years ago which has been very successful. June 29: Process of Penn Mold and Mfg. Co., Dover, O.

MONEL METAL

MANIPULATION AND USE. Monel Metal, S. E. Briggs. West. Machy. World, vol. 13, no. 8, Aug. 1922, pp. 276-277 and 282, 5 figs. Physical properties; directions for manipulation and use.

MUNICIPAL ENGINEERING

CITY MAPS. Applying Efficiency to the Production of City Maps, S. M. Cotten. Eng. News-Rec., vol. 89, no. 8, Aug. 24, 1922, pp. 312-314, 1 fig. Sectional tracings, embodying primary data, printed in duplicate.

N

NATURAL GAS

GASOLINE FROM. The Absorption of Gasoline from Natural Gas, R. C. Cantelo. Can. Chem. & Metallurgy, vol. 6, no. 8 and Aug. and Sept. 1922, pp. 177-179 and 196-200, 1 fig. Aug.: Methods of testing natural gas from gasoline content. Theory and development of absorption process. Sept.: Calculating amount of absorbent necessary for complete removal of gasoline from gas. Results of experiments.

NICKEL ALLOYS

NICKEL-CHROMIUM. Exhaust Valves of Nickel-Chromium Alloy. Motorship, vol. 7, no. 9, Sept. 1922, p. 679, 4 figs. Describes nichrome, an alloy produced by Driver, Harris Co., Harrison, N. J., said to be practically immune to pitting, warping and other destructive forces.

PROPERTIES. Some Nickel Alloys. Metal Industry (Lond.), vol. 21, nos. 4 and 6, July 28 and Aug. 11, 1922, pp. 78-82 and 129-130, 5 figs. Properties and chief features of more important ferrous and non-ferrous nickel alloys.

NICKEL-CHROME STEEL

MANUFACTURE. The Making, Forging and Heat Treating of Nickel Chromium Steels, Harry Brearley. Forging & Heat Treating, vol. 8, no. 8, Aug. 1922, pp. 341-345, 2 figs. Characteristics and nature of nickel-chromium steels; causes of failure and remedy therefor; comparison of nickel and nickel-chromium steels. Lecture before Assn. Drop. Forgers & Stampers.

[illegible]

ABSORPTION TOWERS. Nitric Acid Absorption Towers, J. A. Hall, A. Jaques and M. S. Leslie. Soc. Chem. Industry Jl., vol. 41, no. 16, Aug. 31, 1922, pp. 285T-293T, 4 figs. Results of experimental work carried out in connection with development of mathematical expressions to be used for design of absorption towers for nitrous gases from different sources. Construction and work- [illegible]

NOMENCLATURE

A.S.T.M. COMMITTEE REPORT. Report of Committee E-8 on Nomenclature and Definitions. Am. Soc. for Testing Matls. advance paper for meeting June 26-30, 1922, 11 pp. Report on tentative definitions.

NON-FERROUS METALS

A.S.T.M. COMMITTEE REPORT. Report of Committee B-2 on Non-Ferrous Metals and Alloys. Am. Soc. for Testing Matls. advance paper for meeting June 26-30, 1922, 23 pp., 2 figs. Includes notes on physical properties of A.S.T.M. tentative standard white metal bearing alloys, by John R. Freeman, Jr. Proposed tentative specifications for copper pipe, brass pipe, and seamless admiralty condenser tubes and ferrule stock.

GAS ABSORPTION AND OXIDATION. Gas Absorption and Oxidation of Non-Ferrous Metals, B. Woyski and John W. Boeck. Metal Industry (N. Y.), vol. 20, nos. 7 and 8, July and Aug. 1922, pp. 267-268 and 307-308, 2 figs. Discussion of furnace atmospheres and their relation to condition of metal.

NOZZLE

AERATOR. The Sacramento Floating Type of Aerator Nozzle, Narry N. Jenks. Eng. News-Rec., vol. 89, no. 10, Sept. 7, 1922, pp. 384-386, 8 figs. Central cone of low-head aerator floats on issuing water film; permits passage of trash and gives uniform spray.

O

OIL

WORLD SUPPLY. The Oil Supply of the World, David White. Mech. Eng., vol. 44, no. 9, Sept. 1922, pp. 567-569. Estimates of oil resources of various regions of earth. Economic future as to oil in United States. Measures necessary to be taken in order to increase and conserve domestic supply. (Abridgment.)

OIL ENGINES

BROTHERHOOD-STILL. The "Brotherhood-Still" Oil Engine. Oil Eng. & Finance, vol. 1, no. 24, June 24, 1922, pp. 777-778, 1 fig. Compound steam and internal-combustion engine containing double-action piston with usual air exhaust and admission valves showing phenomenal fuel consumption.

FULLAGAR LAND-TYPE. The Fullagar Oil Engine for Land Purposes. Engineer, vol. 133, no. 3461, Apr. 28, 1922, pp. 466-468, 7 figs. partly on p. 470. Describes land-type engine built on Fullagar system, which is said to have all advantages of marine type, chief among them being excellent balancing of reciprocating parts. See also English Elec. Jl., vol. 2, no. 2, Apr.-July, pp. 61-67, 8 figs.

OIL FUEL

BURNERS. Navy Testing Plant Perfects Oil Burner, Charles E. Kern. Oil & Gas Jl., vol. 21, no. 5, June 29, 1922, pp. 11 and 100. Mechanical pressure of oil atomizes it giving rapid whirling motion inside burner which causes expansion into cone that disintegrates into fine oil mist.

DISTRIBUTION IN INDUSTRIAL PLANTS. Distribution of Fuel Oil in Industrial Plants, J. A. Brown. Forging & Heat Treating, vol. 8, no. 8, Aug. 1922, pp. 336-340, 4 figs. Character of fuel oil defined in terms of temperature, gravity and viscosity; effect of pipe size, velocity and viscosity on friction head; analysis of cost service.

OPEN-HEARTH FURNACES

PROGRESS. Progress in the Open-Hearth Process, Willis McKee. Iron Age, vol. 110, no. 3, July 20, 1922, pp. 147-149, 2 figs. Results from blowtorch furnace; its principles and advantages. Steel-encased regenerators. (Abstract.) Paper read before Am. Foundrymen's Assn.

TALBOT PROCESS. The Talbot Process Compared with other Processes. Iron & Coal Trades Rev., vol. 105, no. 2840, Aug. 4, 1922, p. 146. Conclusions regarding advantages of Talbot process over other open-hearth steel-making processes. Translated from Stahl u. Eisen.

ORE CONCENTRATION

PRACTICE. Concentrating Practice of the Broken Hill South Limited, Broken Hill, New South Wales, Australia. Australasian Inst. Min. & Metallurgy Proc., no. 44, 1921, advance proof, 293 pp., 26 figs. Notes on concentrating plant and slime flotation plant. Describes milling practice which may be regarded as typical for recovery of galena in form of concentrate from Broken Hill ores.

ORE DEPOSITS

BRITISH COLUMBIA. The British Columbia Batholith and Related Ore Deposits, Philip D. Wilson and F. M. Warren. Am. Inst. Min. & Met. Engrs. Trans., no. 1183-M, Aug., 16 pp. and (abstract) in Min. & Metallurgy, no. 188, Aug. 1922, Notes on deposits and production statistics.

ORE SAMPLING

MECHANICAL. Mechanical Sampling of Ore, Charles D. Demond and A. C. Halferdahl. Eng. & Min. J.-Press, vol. 114, no. 7, Aug. 12, 1922, pp. 280-284. Discusses studies and tests made with view to securing accuracy through standardizing operations. Results in three mills prove erratic. Standards for base and precious-metal ores proposed.

ORE TREATMENT

LEACHING WITH SULPHUR DIOXIDE. Leaching Ore With Sulphur Dioxide, Joseph Irving, Jr. Eng. & Min.-Jl.-Press, vol. 114, no. 9, Aug. 26, 1922, pp. 360-364, 7 figs. Experiments at Nevada-Douglas Consolidated Copper Co.'s mines indicate practicability of extracting copper by means of sulphur-dioxide gas; equipment used; detailed data showing results of tests.

OXY-ACETYLENE CUTTING

PRODUCTION COSTS. Oxygen for Cutting Purposes. Eng. Production, vol. 5, no. 98, Aug. 17, 1922, p. 152. Comparative data on production costs.

OXY-ACETYLENE WELDING

INGOT-IRON COMPOSITION. Composition of Ingot Iron for Effective Autogenous Welding (Beschaffenheit des Flusseisens für gute Schmelzflammen-Schweissung), C. Diegel. Forschungsarbeiten auf dem Gebiete des Ingenieurwesens, no. 246, 1922, 44 pp., 146 figs. on supp. plates. Experiments to determine effect of 0.27 per cent Si and 0.25 per cent Ni, which show that Si is injurious while Ni is not.

P

PACKINGS

Labyrinth. Steam Loss in Labyrinth Packings. Dampfverlust in Labyringthdichtungen, A Winkhaus. Zeit des Vereines deutscher Ingenieure, vol. 66, no 33-34, Aug 26, 1922, pp 804-807, 9 figs. Determination of discharge and its application to calculation of a labyrinth.

PAINTS

Accelerated Weathering. Accelerated Weathering of Paints on Wood and Metal Surfaces, Harley A Nelson. Am Soc for Testing Matls advance paper for meeting June 26-30, 1922, 15 pp., 6 figs. Describes effort to reproduce directly on typical surfaces not only changes in some one physical property, but all of more common paint failues observed on painted wood and metal structures.

Black Pigments. The Manufacture and Use of Black Pigments, H. L. Blachford. Can. Chem. & Metallurgy, vol. 6, nos. 7 and 8, July and Aug. 1922, pp. 156-158 and 180-181. Definition, manufacture and uses of carbon, lamp, bone, charcoal and various other blacks.

Specifications. Report of Committee D-1 on Preservative Coatings for Structural Materials. Am. Soc. for Testing Matls. advance paper for meeting June 26-30, 1922, 60 pp., 1 fig. Proposed revised tentative definitions of terms relating to paint specifications; specifications for raw or refined soya bean and perilla oil and raw tung oil; methods of analysis of yellow and orange pigments, blue pigments and chrome green; report on varnish; specifications for carbon black, lampblack, bone black, chrome yellow and chrome green.

Physical Properties. Some Physical Properties of Paints, P. H. Walker and J. G. Thompson. Am. Soc. for Testing Matls. advance paper for meeting June 26-30, 1922, 19 pp., 6 figs. Results of investigations on plastometer measurements, preparation of paint films, effect of varying composition on paint films, thinning power of turpentine, and aging of basic carbonate white lead paints before application.

PAPER MANUFACTURE

Improvements. Recent Advances in Pulp and Paper, Clarence J West. Jl. Indus. & Eng. Chem., vol. 14, no. 9, Sept. 1922, pp. 858-860. Deals with raw materials; improvements in processes; analytical methods; beating, bleaching, and sizing.

Strawboard Wastes. The Treatment and Disposal of Strawboard Wastes, H. B. Hommon. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 6, Aug. 1922, pp. 1397-1402. Complete account of studies made at American Strawboard Mill, Noblesville, Ind., for developing methods to treat wastes resulting from manufacture of paper from staw.

PAPER MILLS

Electric Drive. Sectional Paper Machine Drive, Stephen A. Staege. Paper, vol. 30, nos. 17 and 18, June 28 and July 5, 1922, pp. 9-11 and 17. Electrical way of individual motors has simplified equipment and proved best.

Steam Utilization. Steam Utilization in a Modern Newsprint Mill, S. W. Slater and J. E. A. Warner, Mech. Eng., vol. 44, no. 9, Sept. 1922, pp. 587-592. 6 figs. Analysis of conditions obtaining in modern paper mill manufacturing newsprint, dealing with selection of prime mover, electric vs. rope drive for paper machines, drying of paper, ventilation requirements, etc. (Abridgment.)

Wastes. Wastes from Pulp and Paper Mills Chemically Considered, H. W. Clark. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 6, Aug. 1922, pp. 1393-1396. Writer states it is often possible to remove 70 per cent or more of primary polluting matters of paper-mill wastes. Apparently only wastes recovered with profit as yet are those from soda-pulp process and wastes from paper machine.

PEAT

Manufacturing Plant. The Anrep-Moore Machine Peat Manufacturing Plant. Can. Min. Jl., vol. 43, no. 31, Aug. 4, 1922, pp. 500-502, 2 figs. Describes plant developed by Joint Peat Committee at Alfred, Ont., and its operation.

PILES

Composite. The Raymond Composite Pile, Albert E. Cummings. Wisconsin Engr., vol. 26, no. 8, May 1922, pp. 139-141 and 152, 2 figs. Consists essentially of upper or heavier section of standard Raymond concrete pile superimposed upon wooden pile. Tests made to determine relative strengths of various types of composite pile joints.

PIPE

Pressure. Power Piping for Hydraulic Plants (Conduites forcées pour usines hydrauliques), Auguste Bouchayer. Revue Universelle des Mines, vol. 14, no. 1, July 1, 1922, pp. 1-12 (Civil Engineering Section), 5 figs. Discusses replacing of metal pipes by reinforced-concrete; riveted and welded pipes; arrangements for high and low heads; underground conduits; etc.

PIPE, CAST-IRON

Cement-Lined. Cement-Lined Cast-Iron Pipe at Charleston, S.C., J. E. Gibson. Eng. News-Rec., vol. 89, no. 10, Sept. 7, 1922, pp. 387-390, 3 figs. Tuberculation of tar-coated cast-iron pipe at Charleston and elsewhere; 70 years' experience with cement-lined sheet pipe in many cities suggests cement lining for cast iron; lining method.

PIPE, STEEL

Bending Large. Bending Large Pipe, Charles O. Herb. Machy. (N.Y.), vol. 29, no. 1, Sept. 1922, pp. 1-7, 8 figs. Procedure in hand-bending large-sized wrought-iron and steel pipe while hot and packed with sand.

PIPE, WROUGHT IRON

Heat Losses. Heat Losses from Bare and Covered W. I. Pipe at Temperatures up to 800 Deg. Fahr., R. H. Heilman. Mech. Engr., vol. 44, no. 7, July 1922, pp. 435-437, 3 figs. Presents findings of experimental investigation conducted in Mellon Inst. of Indus. Research of University of Pittsburgh. Empirical formulas are presented whereby loss from insulated pipes of any diameter may be readily calculated. (Abridgment.)

PISTON RINGS

Design. Piston-Rings and Ring Grooves, C. R. Manes. Soc. Automotive Engrs. Jl., vol. 11, no. 3, Sept. 1922, pp. 262-264 and (discussion) 228-231, 1 fig. Defines purpose of piston ring for internal-combustion engine and discusses gas and oil leakage, disputing H. H. Platt's views on these two points in recent paper. Advantage of multiple-piece rings over one-piece type. Table giving width and depth for piston-ring grooves.

Engineering and Manufacturing Practice. Piston-Rings, John Magee. Soc. Automotive Engrs. Jl., vol., 11, no. 3, Sept. 1922, pp. 273-274 and (discussion) 228-231. Comments with view to standardization of best engineering and manufacturing practice. States that cast iron is only satisfactory metal suitable for use in internal-combustion engines. Discusses leakage and oil pumping, width and form, and manufacturing difficulties.

PISTONS

Aluminum. Aluminum Pistons, Ferdinand Jehle and Frank Jardine. Soc. Automotive Engrs. Jl., vol. 11, no. 3, Sept. 1922, pp. 225-228 and (discussion) 228-231, 8 figs. Discusses thermal properties, such as actual operating temperature, temperature distribution, and effect of cooling-water temperature and piston material on piston temperature.

Light-Metal Alloys for. Light Metal Alloys for Pistons, Wallace Dent Williams. Raw Material, vol. 5, no. 5, Aug. 1922, pp. 259-266, 24 figs. Cast aluminum alloy pistons; cast and drawn magnesium alloy pistons. Special contrivances used in tests to investigate operating values of various light-metal pistons; influence of crust of soot.

PITOT TUBES

Wind Velocity, Measurement of. On the Use of Very Small Pitot-Tubes for Measuring Wind Velocity, Muriel Barker. Royal Soc. Proc., vol. 101, no. A712, Aug. 1, 1922, pp. 435-445, 5 figs. Account of experiments and results.

PLANERS

Controller, Electric. Electric Control of Planer Table Movement. Can. Machy., vol. 28, no. 7, Aug. 17, 1922, pp. 21-and 39, 2 figs. Describes Cutler-Hammer full-magnetic planer controller, and its operation.

PNEUMATIC TOOLS

Machining and Assembling. Machining and Assembling Operations on Pneumatic Tools, Howard Campbell. Am. Mach., vol. 57, nos. 2, 3, 4 and 5, July 13, 20, 27 and Aug. 3, 1922, pp. 49-51, 101-104, 134-136 and 175-177, 42 figs. July 13: Drilling air-hammer parts; boring, reaming, grinding and lapping piston holes. July 20: Turning and drilling crankshafts for air motors; machining valves. July 27: Milling and grinding operations on connecting rods for air motors; swaging and milling. Aug. 3: Boring and reaming air-motor cylinders; setting valves; testing brake.

POLES, STEEL

Latticed. Latticed Poles for Electric Lines (Pali a traliccio per linee elettriche), Gino Rebora. Elettrotecnica, vol. 9, no. 21, July 25, 1922, pp. 457-467, 24 figs. Calculation and formulas including Tetmayer's and Euler's; examples of practical calculation.

POLES, WOODEN

Preservative Treatment. Preservative Treatment of Poles in Part, P. M. McCullough. Telegraph and Telephone Age, no. 16, Aug. 16, 1922, pp. 372-374. Discusses treatment of cedar poles from practical and theoretical sides. Causes of decay; brush, submersion, butt and perforation treatments.

PORTS

Equipment, Mechanical. Design of a Port to Take Full Advantage of Mechanical Equipment, Carrel R. Thompson. Eng. and Indus. Management, vol. 7, nos. 16 and 17, June 15 and 29, 1922, pp. 513-517 and 554, 4 figs. Design of general cargo pier to take full advantage of miscellaneous freight-handling equipment.

POWER GENERATION

Prime-Movers Statistics. Prime Movers in Central Stations Total 19,737,361-Hp Elec. World, vol. 80, no. 4, July 22, 1922, p. 169. Analysis of development of electric light and power companies indicates total of 13,331,933 hp. in steam motors, of which 87 per cent is for steam turbines; boiler installation totals 4,042,922 hp.

POWER PLANTS

Design. Developments in Power Station Design. Engineer, vol. 133, nos. 3459, 3461, 3463, 3464, 3465, 3466 and 3467, Apr. 14, 28, May 12, 19, 26, June 2 and 9, 1922, pp. 406-409, 8 figs.; 457-459, 7 figs.; 529-532, 12 figs.; 545-547, 11 figs.; 574-578, 14 figs.; 608-610, 13 figs.; and 631-634, 14 figs. Apr. 14: Parsons 10,500 kw. turbo-generator at Carville station. Apr. 28: Hickson-Hargreaves surface condensing plant, ejectair, and jet condenser. May 12: Mirlees-Watson condensing plant built for Bankside station of London Elec. Light Co.; jet condensers with Delas air extractors. May 19: Flow of fluids in pipes; electrical flow meters. May 26: Circular-type condensers of English Elec. Co.; Willan's condensing plant at Dalmarnock. June 2: Air filters for power-house use; water-cooled rotors; design of switchgear. June 9: Transformers; current-limiting reactances; rectifiers.

Economies. Power Plant Economies, George E. Wood. Coal Industry, vol. 5, no. 6, June 1922, pp. 267-270, 5 figs. Practical value of accurate boiler room records; evil results of scale accumulation; losses from soot as high as $15,000 per year; uncovering of air leaks and bad pipe connections.

POWER TRANSMISSION

Paper Mills. Power-Transmission Systems of Three Big Paper Mills, H. Hilman Smith, Jr. Belting, vol. 21, no. 2, Aug. 1922, pp. 21-25, 8 figs. Layouts in Haverhill, Piermont and Chicago divisions of Robert Gair Co. Rubber belts used chiefly.

PRECIPITATION

Electrical. Electrical Precipitation of Solids From Smelter Gases, Ross B. Rathbun. Am. Inst. Elec. Engrs. Jl., vol. 41, no. 9, Sept. 1922, pp. 676-687, 9 figs. Fundamental principles of process in its simplest form are set forth and theory of back ionization and phenomena of discontinuous dielectric is discussed.

PRODUCER GAS

Production and Use. Production of Producer Gas and Use in Open-Hearth Furnaces (Cosidérations sur la production et l'utilisation du gaz pauvre de gazogènes pour le chauffage des fours Martin), G. Husson. Revue de l'Industrie Minérale, no. 38, July 15, 1922, pp. 373-406, 3 figs. Technical value of a gas; theory of gasification of coke; influence of different kinds of coal; handling of different gas producers; etc.

PULLEYS

Automatically Lubricated. Pulleys with Automatic Lubrication, J. H. Blakey. Power Plant Eng., vol. 26, no. 15, Aug. 1, 1922, p. 759, 5 figs. Description of pulley of French origin with automatic lubrication for use especially in cranes which are difficult of access.

PULVERIZED COAL

HAZARDS. Pulverized Fuel and Its Hazards. Steam, vol. 30, no. 3, Sept. 1922, pp. 67-71. Advantages of pulverized fuel, considers types of systems, dryer, [illegible] construction crushing, drying and pulverizing with regard to explosion hazard.

PUMPING

HOT LIQUIDS. The Pumping of Hot Liquids, Wm. Mason. Gas. Jl., vol. 159, no. 3092, Aug. 16, 1922, pp. 374-375, 2 figs. Difficulties are explained and method of circumventing them set forth.

PUMPS, CENTRIFUGAL

DEVELOPMENT AND OPERATION. Centrifugal Pumps, H. Kilian. Fördertechnik u. Frachtverkehr, vol. 15, no. 16, Aug. 4, 1922, pp. 212-216, 7 figs. Notes on development, operation, delivery and suction head, efficiency, power consumption, regulations for erection, attendance, etc.

DREDGING AND SAND PUMPING. Pumps Used in Dredging and for Pumping Sand, E. T. Keenan. Cement, Mill and Quarry, vol. 21, no. 4, Aug. 20, 1922, pp. 29-31, 3 figs. Design of pumps handling sand and rock.

ELECTRICALLY DRIVEN. Electrically Driven High Pressure Centrifugal Pump. Engineer, vol. 133, no. 3465, May 26, 1922, p. 591, 3 figs. partly on p. 584. Capable of delivery 800 gal. per min. at pressure of 1150 lb. per sq. in. Installed in pumping station, Manchester, England.

PYROMETERS

RADIATION. The New Radiation Pyrometer "Pyro" (Das neue Strahlungs-Pyrometer "Pyro"). Zeit. für die gesamte Giessereipraxis, vol. 43, no. 27, July 15, 1922, p. 377. Its advantages, simplicity of operation, and application to high and low temperatures.

R

RADIOTELEGRAPHY

STATIONS. The Trans-Continental Wireless Station of Sainte Assise. Wireless World, vol. 10, no. 22, Aug. 26, 1922, pp. 689-692, 5 figs. Details of equipment.

RAILS

HEAT TREATMENT. The Improvement of Rails and Tyres by Means of Heat Treatment, James Waite. Commonwealth Engr., vol. 9, no. 12, July 1, 1922, pp. 435-438, 4 figs. Notes on Sandberg treatment.

JOINTS. Why Use Base Plate With Welded Rail Joints? Howard H. George. Elec. Ry. Jl., vol. 60, no. 8, Aug. 19, 1922, pp. 265-266. Base plates not needed if correct design of joint plate is worked out additional weight of metal and increased amount of welding do not economically solve problem.

WEAR, MEASUREMENT OF. Determination of Rail. Wear for Valuation Purposes, J. P. Newell. Eng. News-Rec., vol. 89, no. 8, Aug. 24, 1922, pp. 310-312, 3 figs. Cross-sections accurately measured in field; rails rated by scientific analysis of observed deterioration. Describes rail pantograph invented by S. W. Fairweather.

RAILWAY ELECTRIFICATION

BRITISH. British Railways Electrification. Elec. Ry. & Tramway Jl., vol. 46, no. 1136, June 16, 1922, pp. 257-264, 5 figs. South Eastern and Chatham electrification. London Tube; Great Eastern; London and North-Western; London, Brighton and South-Coast, and Metropolitan railways.

LONDON & NORTH WESTERN. Electrification of the London and North Western Railway. Elec. Times, vol. 62, no. 1604, July 13, 1922, pp. 27-28, 2 figs. Data on electrification of suburban lines recently completed by conversion of line from Euston to Willisden. Description of rolling stock, power-generating stations and auxiliaries. Indicators with names of stations carried at each end of train.

RAILWAY MOTOR CARS

DIESEL-ELECTRIC. Swedish Railways Increase Use of Diesel Electrics. Elec. Ry. Jl., vol. 60, no. 6, Aug. 5, 1922, pp. 193-195, 4 figs. Success of small motor cars leads to introduction of those with 160 and 250 hp. capacity; reduction in operating cost and improved service; performance data, dimensions and weights.

GASOLINE. The Gasoline-Driven Motor-Coach for Railroad Service, Charles O. Guernsey. Soc. Automotive Engrs. Jl., vol. 11, no. 3, Sept. 1922, pp. 275-278 and (discussion) 278-280 and 283, 11 figs. Why so little progress has been made in developing railroad equipment operated by gasoline engines and what the filed is for this class of equipment.

RAILWAY OPERATION

FREIGHT RATES. Board of Railway Commissioners' Judgment and Order Reducing Freight Rates, etc. Can. Ry. and Mar. World, no. 294, Aug. 1922, pp. 395-400. D[illegible] of Can. Board of Ry. Commissioners reducing freight rates.

RECLAMATION, DECENTRALIZED. De-Centralized Reclamation on the C.M. & St.P. Railway. Ry. Rev., vol. 71, no. 5, July 29, 1922, pp. 131-137, 8 figs. Policy of road to localize reclamation work wherever possible appears to possess certain advantages both from standpoint of reduced length of haul and wider co-operation enlisted. Account of organization of work and reclamation activities on road during past year.

[illegible] The Report of the Automatic Train Control Committee. Ry. Gaz., vol. 37, no. 7, Aug. 18, 1922, pp. 228-230. Conditions to be satisfied; essential requisites; anticipated cost and summary of recommendations.

Official Report on Train Control for British Railways. Ry. Rev., vol. 71, [illegible] 1922, pp. 115-117 and 140-144. Report of Automatic Train Control Committee advising introduction of control at least at selected points.

RAILWAY SHOPS

[illegible] Railway Shop, F. F. Collins. Ry. Rev., vol. 71, no. 3, July 15, 1922, pp. 69-72, 6 figs. Economy and wide range [illegible] not generally appreciated. Paper read before Assn. of Ry. Elec. Engrs.

RAILWAY SIGNALING

[illegible] Engineer, vol. 134, no. [illegible] automatic signaling between Liverpool, Central and Hamilton-Square stations, effects of which would allow number of block signals sections between stations named to be increased [illegible]

RAILWAY TERMINALS

DESIGN. Factors Governing the Design of Passenger Terminals, A. S. Baldwin. Ry. Age, vol. 73, no. 10, Sept. 2, 1922, pp. 429-435, 1 fig. Analysis of operating conditions which influence plans for large station. Abstracted from report before Int. Ry. Congress in Rome.

RAILWAY TIES

CREOSOTING PLANT. A Sleeper Creosoting Plant. Engineer, vol. 133, no. 3463, May 12, 1922, p. 534, 4 figs. partly on p. 526. Describes creosoting plant built for Kenya, East Africa, comprising two large receptacles, of which lower one is working cylinder, together with necessary pumps and boiler. Capacity is 900 meter-gage sleepers per day of 8 hr.

TREATED, TESTS RESULTS. Treated Tie Records on the C.B. & Q.R.R. Ry. Rev., vol. 71, no. 9, Aug. 26, 1922, pp. 272-274, 1 fig. Results of 12 years of tests, which show that ties treated with creosote are in best condition after 12 years' service and ties treated with mixture of zinc chloride and creosote are giving better service than those treated with zinc chloride alone.

RAILWAY TRACK

TRACK BOLTS, IMPACT LOADS ON. Determining the Impact Loads on Track Bolts. Ry. Age, vol. 73, no. 7, Aug. 12, 1922, pp. 277-278, 4 figs. Tests performed on Philadelphia & Reading to evaluate and compare induced stresses.

RAILWAY YARDS

MONCTON, CAN. Improvements to Moncton Yard and Engine Facilities, S. B. Wass. Eng. Jl., (Eng. Inst. Can.), vol. 5, no. 9, Sept. 1922, pp. 445-450, 2 figs. Construction methods employed to minimize interference with traffic.

RAILWAYS

FOREIGN PRACTICE. Foreign Railway Practice, J. Carlier. Inst. of Transport Jl., vol. 3, no. 5, July 1922, pp. 426-433 and (discussion) 433-436, 1 fig. Remarks on electric traction; notes on some new forms of locomotives, including Heilmann, Ramsay, Zoelly, Société Cockerill, Pieper, Strang, Sulzer Freres, etc.; actual traction tendency.

REFRACTORIES

FIRECLAYS. Manufacture on Fireclay Refractories, Alan G. Wikoff. Chem. and Met. Eng., vol. 27, no. 10, Sept. 6, 1922, pp. 505-509, 7 figs. Outline of plant operations at Evens & Howard Fire Brick Co., St. Louis; forming brick and special shapes, drying, burning.

ZINC SMELTING. Refractories for Zinc Smelting, G. C. Stone. Am. Ceramic Soc. Jl., vol. 5, no. 9, Sept. 1922, pp. 597-601, 2 figs. Deals with roasting furnaces, oxide furnaces, spelter furnace linings, retorts, and condensers.

GLASS. A Critical Review of the Provisional Specifications for Glass Refractory Materials, W. J. Rees. Soc. of Glass Technology Jl., vol. 6, no. 22, Aug. 1922, pp. 181-193 and (discussion) pp. 193-204, 2 figs. Discusses specifications for silica bricks and cement, tank blocks, and pot clays.

THERMAL CONDUCTIVITY. Report of Committee C.8 on Refractories. Am. Soc. for Testing Matls. advance paper for meeting June 26-30, 1922, 14 pp. Status of thermal conductivity in specifications for refractories.

REFRIGERATION

COMPRESSORS. Refrigeration for the Power Plant Engineer, T. H. Fenner. Power House, vol. 15, nos. 10, 11 and 12, May 20, June 5 and 20, 1922, pp. 19-22, 28-29, 31-32 and 34, 12 figs. May 20: Single and double-acting compressor, water jacketing, wet compression and oil sealing, oil separators, condensers and liquid receivers are described. June 5: Expansion valve and its function. June 20: Absorption process; aqua ammonia; parts and operating features of machine.

TWO SUCTION PRESSURES. Refrigeration with Two Suction Pressures, J. H. Macintire. Power, vol. 56, no. 8, Aug. 22, pp. 279-281, 5 figs. Author attempts to show where there will be an advantage in compressing gas using two suction pressures in same cylinder.

REFRIGERATING MACHINES

CO_2 COMPRESSOR. The Carbonic Compressor, H. J. Macintire. Refrig. World, vol. 57, no. 7, July 1922, pp. 16-18, 3 figs. Advantages and disadvantages of CO_2 machines considered with diagram showing horsepower per ton of refrigeration for ammonia and carbon dioxide.

REFRIGERATING PLANTS

AMMONIA LEAKS, LOCATING. Locating Ammonia Leaks in Refrigerating Plants, A. J. Dixon. Southern Engr., vol. 38, no. 1, Sept. 1922, pp. 72-73, 1 fig. Practical pointers regarding simple methods of detecting ammonia leaks in piping, coils and condensers.

RESEARCH

CANADA. Progress of Research in Canada. Can. Engr. vol. 43, no. 5, Aug. 1, 1922, pp. 218-221. Brief account of work of Advisory Council for Scientific and Industrial Research. Included are reports on peat fuel, low grade and sulphide ores, liquefication of helium, industrial fatigue, and utilization of flax straw.

RESERVOIRS

LONDON. New London Service Reservoirs. Engineering, vol. 113, nos. 2942 and 2943, May 19 and 26, 1922, pp. 612-614 and 648, 15 figs. Some features of construction of reservoirs for Metropolitan Water Board in Kent district.

RIVERS

JETTY EXTENSION. Extension of Fraser River Jetty to Improve Entrance. Eng. News-Rec., vol. 89, no. 8, Aug. 24, 1922, pp. 318-320, 2 figs. Problems presented by lower reaches of river of Pacific coast and efforts to solve them.

RIVETING

EFFICIENCY. Experiments to Determine the Changes Taking Place in Sheet Metal During Riveting (Versuche zur Ermittlung der in den Blechen beim Nieten bewirkten Formänderrungen), R. Baumann. Forschungsarbeiten auf dem Gebeite des Ingenieurwesens, no. 252, 1922, 66 pp., 132. figs. Effects of high pressure in riveting; cold, warm and hot riveting; deformation due to pressure of rivet head. Advises not to apply unnecessarily high pressure in riveting.

ROAD CONSTRUCTION

UTILIZING OLD ROAD METAL. Utilizing Existing Road Metal in New Construction, G. F. Schlesinger. Eng. News-Rec., vol. 89, no. 11, Sept. 14, 1922, pp. 428-430, 2 figs. Detail surveys determine usable material; three conditions of old road classification.

ROAD MATERIALS

Tests. Report on Committee D-4 on Road and Paving Materials. Am. Soc. for Testing Matls. advance paper for meeting June 26-30, 1922, 26 pp., 1 fig. Proposed tentative method of test for consistency of Portland cement concrete for pavements or for pavement base; block for road granite block pavements; block for Durax granite pavements; asphalt cement for bituminous macadam pavements and asphalt blocks; etc.

ROADS

Bates Experimental. The Bates Experimental Road. Ill. Dept. of Pub. Works and Buildings Division of Highways Bul. no. 1, June 8 and 17, 1922. Bul. no. 1, 13 pp. 1 fig., including descriptive data on road, by Clifford Older. Bul. no. 3, 8 pp. 10 figs. Bul. no. 4, 7 pp. 10 figs. Results of traffic runs.

Bituminous-Bound. Bituminous Bound Roads, David W. Johnston. Can. Engr., vol. 42, no. 3, July 18, 1922, pp. 162-164. Method of applying bituminous treatment to new road construction and reconstruction of macadam or gravel roads including surface treatment to water bound macadam or gravel road beds.

Drainage for Prairie. Drainage for Prairie Regions, H. R. MacKenzie. Eng. and Contracting, vol. 58, no. 10, Sept. 6, 1922, pp. 236-238. Methods employed in Province of Saskatchewan. Paper presented before Can. Good Roads Assn.

England. Roads and Road-Making in England, J. Haydon Cardew. Surveyor, vol. 33, no. 2, Mar. 1, 1922, pp. 38-43 and discussion, 43-47. Investigation of English roads to determine their adaptability for Australia.

Improving Earth, Clay and Sand. Improving Earth, Clay and Sand Roads, J. D. Robertson. Can. Engr., vol. 42, no. 26, June 27, 1922, pp. 655-656. Physical and soil conditions in Alberta; methods of grading prairie roads and roads in timbered districts; cost of grading. Paper read at Convention of Can. Good Roads Assn.

Prairie. Experiments in Improving Prairie Roads, K. A. Clark. Eng. and Contracting, vol. 58, no. 10, Sept. 6, 1922, pp. 227-228. Investigations being conducted at University of Alberta for utilization of bituminous sand deposits. Paper presented before Can. Good Roads Assn.

Road Construction in Prairie and Timbered Country, J. D. Robertson. Eng. and Contracting, vol. 58, no. 10, Sept. 6, 1922, pp. 230-232. Methods used in Province of Alberta. Paper presented before Can. Good Roads Assn.

ROADS, CONCRETE

Slag. Slag-Concrete Roads — Their Construction and Wear, C. S. Hill. Eng. News-Rec., vol. 89, no. 11, Sept. 14, 1922, pp. 439-440. Conclusions based on inspection of over 100 mi. of concrete road built with slag aggregate and in service from one to nine years. Some difficulties in manipulation and peculiarities of wear.

Test Highway. Concrete Highway Test at Pittsburg, California, Chas. Geiger. Concrete, vol 18, no. 1, July 1922, pp. 23-25, 7 figs. Eliptically shaped roadway 18 ft. wide and 1371 ft. long of plain and reinforced concrete; various conditions such as might be caused by weather and usage, and results of same.

ROLLING MILLS

Electrically Driven. New Development in Rolling Mill Drive, A. K. Bushman. Blast Furnace and Steel Plant, vol. 10, no. 9, Sept. 1922, pp. 467-469, 3 figs. Describes new electric drive for hot strip mill of Trumbull Steel Co. at Warren, Ohio.

Plate Mills, Motor Drive for. Special Drive Designed for Plate Mill, F. D. Egan. Blast Furnace and Steel Plant, vol. 10, no. 9, Sept. 1922, pp. 461-463, 3 figs. Describes main motor drive for new 100-in. 3-high plate mill for Nat. Stamping and Enameling Co., rated 3,000 hp., 40 deg. cent., 2,200 volt, 3 phase, 60 cycle, 236 r.p.m.

Sheet Mills. Boscarelli System of Sheet Rolling. Iron and Coal Trades Rev., vol. 105, no. 2842, Aug. 18, 1922, pp. 220-221, 10 figs. partly on p. 222. Advantages claimed are (1) saving in labour and fuel; (2) thickness of sheets more uniform, and thinner sheets can be rolled; and (3) increased production.

RUST PREVENTION

Parker Process. Parkerizing — A Rustproofing Process, L. C. Morrow. Am. Mach., vol. 57, no. 10, Sept. 7, 1922, pp. 361-364, 6 figs. Describes process and application. Kinds of parts treated. Apparatus and equipment required.

S

SANITATION

Motorized Laboratory for Resort. Motorized Laboratory for Resort Sanitation Work, W. C. Brockway and George C. Stucky. Eng. News-Rec., vol. 89, no. 11, Sept 14, 1922, pp. 430-432, 2 figs. Describes laboratory, car consisting of a stock chassis on which is mounted a bus body 12 ft. long, 5 ft. wide and 6½ ft. high. [illegible]

Underground. Underground Hygiene and Sanitation, R. R. Sayers. U.S. Bur. of Mines Reports of Investigations, no. 2391, Aug. 1922, 11 pp. Consideration of safe practices with drinking water; safe methods of sewage disposal; safe practices in ventilation.

SCREW MACHINES

Automatic. Automatic Production of Parts, C. A. Handschin. West. Machy. World vol. 13, no. 8, Aug. 1922, pp. 279-282, 4 figs. Notes on use of modern screw machines and design of cams for automatic duplication of special forms.

Economical Production on Automatics. Eng. Production, vol. 5, no. 99, Aug. 24, 1922, pp. 172-176, 22 figs. Principles underlying efficient tooling and caming of automatic screw machines. Examples of automatic production illustrating uses of standard Brown & Sharpe tools.

SCREW THREADS

Measurement. Work at the National Physical Laboratory — II. Machy. (Lond.), vol. 20, no. 514. Aug. 3, 1922, pp. 558-561, 7 figs. Internal effective diameter measurement of screw threads.

SEMI-STEEL

French Opinion of. A French Opinion of Semi-Steel. Foundry Trade Jl., vol. 26, no. 313, Aug. 17, 1922, pp. 128-129, 2 figs. Communication by E. Ronceray on J. Cameron's paper on semi-steel.

Metallurgy. The Metallurgy of Semi-Steel, David McLain. Foundry Trade Jl., vol. 26, no. 312, Aug. 10, 1922, pp. 110-114, 8 figs. Discusses potentialities, merits and developments.

Production and Applicability. Melting Steel and Cast Iron together in the Cupola, J. Hogg. Foundry Trade Jl., vol. 26, no. 134, Aug. 24, 1922, pp. 160-162. Practical details based on author's experience; applicability of semi-steel.

SEWAGE DISPOSAL

Activated Sludge. Disposal of Activated Sludge, R. H. Eagles. Public Works, vol. 53, no. 6, Aug. 1922, pp. 111-112. Use of sulphur dioxide gas has been tested at Houston, Indianapolis and Gastonia and appears to produce ionic condition favourable to dewatering, prevent putrefaction and increase ammonia content.

Large Activated-Sludge Plant for Chicago Sanitary District. Eng. News-Rec., vol. 89, no. 8, Aug. 24, 1922, p. 324. To serve 800,000 population in 1930. Bar screens, grit chamber, fine screens, Dorr thickeners.

Aeration. Aeration Experiments at Bury, Joshua Bolton. Can. Engr., vol. 43, no. 8, Aug. 22, 1922, pp. 282-283. Development of activated sludge process in England; successful application at Bury; method of dealing with tank effluent; results of analysis. Paper before Instn Managers of Sewage Disposal.

Treatment. Some Recent Experiments in the Process of Sewage Disposal, J. W. Haigh Johnson. Surveyor, vol. 62, no. 1596, Aug. 18, 1922, pp. 103-104. Evolution of sewage treatment; gaseous interchange during purification; rate and intensity of oxidation.

Treatment. Lime vs. Electrolytic. Lime Treatment of Sewage Compared with Direct-Oxidation, Roy S. Lanphear. Eng. News-Rec., vol 89, no. 7, Aug. 17, 1922, pp. 276-278. Study of Easton tests and working and experimental results at Worcester, Mass., with lime alone aga nst electrolytic method.

Treatment-Plant Operation. Operation of Sewage Treatment Plants. Eng. and Contracting, vol. 58, no. 11, Sept. 13, 1922, pp. 249. Useful suggestions given in booklet prepared by Burns & McDonnell, Kansas City, Mo. (Abstract.)

SEWER CONSTRUCTION

Data, 1921-22. Tabulated Sewerage Data. Public Works, vol. 53, no. 6, Aug. 1922 pp. 124-113. From several hundred city engineers in all parts of country, giving amounts and kinds of sewers laid during 1921 and 1922, jointing material used in pipe sewers, and other details.

SHIP PROPULSION

Gas Turbines. The Prospects of Gas Turbine Development for Ship Propulsion. Shipbldg and Shipg. Rec., vol. 20, no. 7, Aug. 17, 1922, pp. 211-212. Lines of investigation; difficulties of high temperatures; efficiency; power and size.

SHIPWORMS

Protection Against. Marine Borers, W. G. Atwood. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 6, Aug. 1922 pp. 1408-1424, 7 figs. Study of teredo and crustacean groups, their destructive work and means of protection.

SPRINGS

Elliptic, Calculation of. The Calculation of Elliptic Springs, W. H. Armstrong. Ry. Mach. Engr., vol. 96, no. 8, Aug. 1922, pp. 438-440. Formulas and tables for rapid determination of capacity and deflexion.

Leaf. Modern Methods of Making Leaf Springs, E. F. Lake. Iron Age, vol. 109, nos. 19 and 20, May 11 and 18, 1922, pp. 1269-1274 and 1343-1346, 12 figs. May 11: Continuous process for automobile springs; preparing plates; automatic hardening, forming and quenching machines. May 18: Tempering furnaces; assembling, testing and inspecting.

STEAM

Flow in Pipes. Capacities of Steam Heating Mains as Affected by Critical Velocities of Steam and Condensate Mixtures, F. C. Houghten and L. Ebin. Am Soc. Heat. and Vent. Engrs. Jl., vol. 28, no. 6, Sept. 1922, pp. 643-648 and (discussion) pp. 649-654, 4 figs. Report of co-operative work of this Society and U.S. Bur. of Mines Experiment Station, Pittsburgh.

The Critical Velocity of Steam in One-Pipe Systems, F. F. Giesecke. Am. Soc. Heat and Vent. Engrs. Jl., vol. 28, no. 6, Sept. 1922, pp. 637-642, 5 figs. The term, one-pipe system, is used to designate steam-heating system in which steam flows in one direction and condensate in opposite direction through same pipe at same time. (Discussion), pp. 649-654.

Pressure-Reducing Valve. A Unique Reducing Valve, C. C. Brown. Power Plant Eng., vol. 26, no. 18, Sept. 15, 1922, pp. 912-913, 4 figs. Describes chronometer valve, a specially designed arrangement for reducing steam pressure, used successfully in large sugar refinery plant.

Properties at High Pressure. Properties of Steam at High Pressures, G. Eichelberg. Mech. Eng., vol. 44, no. 7, July 1922, pp. 447-449, 6 figs. Investigation into values of heat of vaporization of steam. Author attempts to establish relation between exponents in adiabatic equation, heat vaporization, and specific heats of steam, and measure indirectly specific heats of saturated steam by using this relation. Translated from Zeit. des Vereines deutscher Ingenieure, vol. 66, no. 12, Mar. 25, 1922, pp. 275-277.

Raising, Electric. Steam Raising by Electricity. Elec. Rev., vol. 91, no. 2331, July 28, 1922, pp. 140-141, 2 figs. Economic and some mechanical features including description of 18,000-kw. 3-unit electric steam generator.

STEAM ACCUMULATORS

Electric Hot-Water and. Electric Heat-Storage Plants (Elektrische Wärmespeicheranlagen), Zeit. des Vereines deutscher Ingenieure, vol. 66, nos. 33-34, Aug. 26, 1922, pp. 793-796, 8 figs. Description of plants for storage of heat in form of hot water or steam. Calculation and economy of such accumulatios. Information from Sulzer Bros., Winterthur, Switzerland.

STEAM ENGINES

Exhaust Energy, Use of. Using Exhaust Energy in Reciprocating Engines, J. Stumpf and C. C. Trump. Mech. Eng., vol. 44, no. 6, June 1922, pp. 369-372, 15 figs. Theoretical problems are discussed and practical applications to either single-cylinder or multi-cylinder engines are suggested.

Heat Transformers. A New and a Long Life to the Steam Engine, Wm. P. Durtnall. Petroleum Times, vol. 7, no. 180, June 17, 1922, p. 857. Describes paragon heat-transformer which converts small volume of gases at 3,500 deg. to a larger volume in form of perhaps 200-lb. steam at temperature of 720 deg. Fahr. without use of ordinary boilers.

Triple-Expansion, Compounding. The Compounding of a Triple Expansion Engine Engineering, vol. 114, no. 2955, Aug. 18, 1922, pp. 203-206, 11 figs. Details of conversion work carried out on triple-expansion vertical Corliss engine.

Valve Leakage. Experiments on Steam Engine Valve Leakage, J. E. Bycroft. Engineer, vol. 134, no. 3473, July 21, 1922 .pp. 62-63, 5 figs. Results of experiment carried out by author in investigating leakage of steam past a piston drop valve-in-drum designed to supply steam to central exhaust or uni-flow engine.

STEAM PIPING

Testing Coverings. Efficiency of Steam-Pipe Coverings at High Temperatures. Engineering, vol. 114, no. 2953, Aug. 4, 1922, p. 155, 2 figs. Describes apparatus for determining efficiency of steam-pipe coverings designed by C. Jakeman of Nat. Physical Laboratory and constructed there.

STEAM POWER PLANTS

Condensate Disposal. Disposal of Condensate in Power Plants, Charles L. Hubbard. Nat. Engr., vol. 26, no. 9, Sept. 1922, pp. 398-402, 12 figs. Determination of method to be used; examples in use for varied services; operating details.

STEAM TURBINES

Belliss and Morcom. The Belliss and Morcom Steam Turbine. Engineering, vol. 113, nos. 2947 and 2948, June 23 and 30, 1922, pp. 773-776 and 803-805, 36 figs. partly on supp. plate. Review of reciprocating engines and turbines manufactured by this company. Producing turbines from 10 kw to 10,000 kw. Destructive factors.

Blades, Machining. Machining Turbine Blades. Machy. (Lond.), vol. 20, no. 514, Aug. 3, 1922, pp. 537-543 and 547. Machines and methods employed in works of Wm. Beardmore & Co., Ltd., Dalmuir.

High Pressure and Superheat. Possibilities of High Pressure and Superheat for Steam Turbines, J. A. Polson. Power Plant Eng., vol. 26, no. 18, Sept. 15, 1922, pp. 893-896, 3 figs. Theoretical discussion of problems from standpoints of constant heat content, constant temperature, and constant pressure.

Operation. Steam Turbine Operation, L. W. Heller, Assn. Iron and Steel Elec. Engrs. vol. 4, no. 9, Sept. 1922, pp. 673-699, 14 figs. Discusses methods used by the Duquwanw Light Co., Pittsburgh, in operation of steam-generating equipment on their system.

Trip Valves and Emergency Governors. Steam-Turbine Emergency Governors and Trip Valves, A. D. Palmer. Power, vol. 56, no. 9, Aug. 29, 1922, pp. 324-326, 8 figs. Different types are described.

STEEL

Alloy. *See Alloy Steels.*

Carbon. Treatment of Carbon Steels, Dean Harvey, Am. Mach., vol. 57, no. 10, Sept. 7, 1922, pp. 378-379. What various chemical compositions and treatments in steel making produce. Properties and uses of some steels. Methods of working.

Chromium. *See Chromium Steel.*

Cold-Drawn. Advantages and Limitations of Cold Drawn Steel in Automotive Work, Walter Rosenhain. Automotive Industries, vol. 47, no. 10, Sept. 7, 1922, pp. 469-472, 8 figs. Cold drawn work produces excellent finish and operations are simple and fool-proof. Necessity for high ductility limits such work to softer grades of material. Notes on soft metals, effects on microstructures, bending, annealing, and alloy steels.

Gases in. Amount of Gases in Steel. Iron Age, vol. 110, no. 9, Aug. 31, 1922, p. 534. Results of some new German methods of analysis on basic Bessemer metal. Translated from article by Oberhoffer and Piwowarsky in Stahl u. Eisen, May 25, 1922.

High-Speed. *See Steel, High-Speed.*

Nickel-Chrome. *See Nickel-Chrome Steel.*

Rate of Loading, Effect of. Effect of Rate of Loading on Tensile Properties of Boiler Plate, H. J. French. Chem. and Met. Eng., vol. 27, no. 7, Aug. 16, 1922, pp. 309-310. Effect of decrease in rate of leading on steel is different above and below blue heat, but little variation in tensile properties was observed when tests were performed 30 times as fast as ordinarily.

Rustless. Rustless Steels (Rostfrei Stähle), Karl Daevew. Stahl u. Eisen, vol. 42, no. 34, Aug. 24, 1922, pp. 1315-1320, 5 figs. Notes on composition, properties, method of treatment and uses.

Semi-Steel. *See Semi-Steel.*

Stainless. Stainless Steel at High Temperatures, H. J. French. Iron Age, vol. 110, no. 7, Aug. 17, 1922, pp. 404-405, 3 figs. Heat treatment which produces greatest strength for use in valves of internal-combustion engines. Published by permission of Bur. of Standards.

Thermal Expansion. Thermal Expansion of a Few Steels, Wilmer Souder and Peter Hidnert. U.S. Bur. of Standards Sci. Papers, vol. 17, no. 433, Apr. 10, 1922, pp. 611-626, 22 figs. Data are given on 28 specimens of iron and steel. Review of previous work on expansion.

STEEL CASTING

Specifications. The Trend of Specifications for Steel Castings, E. R. Young. Blast Furnace and Steel Plant, vol. 10, no. 9, Sept. 1922, pp. 463-466. General discussion covering important features such as chemical composition, physical properties, ductility and testing.

Tensile Properties. Tensile Properties of Steel Castings, Lawford, H. Fry. Am. Soc. for Testing Matls. advance paper for meeting June 26-30, 1922, 23 pp., 8 figs. Study of grades currently used for railroad service.

STEEL, HEAT TREATMENT OF

Annealing. Annealing, Tempering and Reheating (Recuit, Trempé et Revenu), Signa. Métallurgie, vol. 54, nos. 27 and 28, July 6 and 13, 1922, pp. 992-994 and 1029-1030. Discusses operations in detail and their effect on steel.

STEEL, HIGH-SPEED

Heat Treatment. Shrinkage and Expansion of High-Speed Steel Due to Heat-Treatment, Marcus A. Grossmann. Chem. and Met. Eng., vol. 27, no. 11, Sept. 13, 1922, pp. 541-544, 2 figs. Describes tests undertaken to obtain data on amount which should be allowed for shrinkage or expansion. Results throw sidelight on nature of reactions taking place during heat treating.

STEEL MANUFACTURE

Bessemer Converter Plants. Modern Developments in Small Bessemer Converter Plants in Germany, Hubert Hermann. Eng. Progress, vol. 3, no. 8, Aug. 1922, pp. 173-176, 8 figs. Action of small converters; working arrangement [illegible] metallurgical process.

Direct Process. [illegible] Steel Direct from the Ore, Ralph Whitfield. Iron and Coal Trades Rev., vol. 105, no. 2838, July 21, 1922, p. 84, 2 figs. [illegible]

Without Pig Iron. [illegible] Pig Iron, Edwin F. Cone. Iron Age, vol. 110, no. 10, Sept. 7, 1922, pp. 585-586. "Scrap and Carbon" basic open-hearth process as employed at an Eastern plate mill; residual manganese [illegible]

[illegible] Steel Mill [illegible] B. G. [illegible] and W. [illegible] Assn. Iron and Steel Elec. Engrs. [illegible] Sept. 1922, pp. 545-[illegible] Review of [illegible]

Heat Balances. Heat Balances of Blast Furnace and Steel Plants, W. Trinks. Blast Furnace and Steel Plant, vol. 10, no. 9, Sept. 1922, pp. 451-456, 4 figs. Gives chart showing heat balance for uneconomical, average, economical, and ideally operated [illegible] plant.

STOKERS

Bituminous-Coal-Burning. Burning Bituminous Coal on Stokers. Mech. Eng., vol. 44, no. 6, June 1922, pp. 373-374 and 381. Three papers by G. E. Wood, O. J. Richmond, and R. A. Sanders, on stoker operation with soft coal, presented before Joint Fuel Conference of New Haven branch of A.S.M.E., New Haven Chamber of Commerce, and other engineering societies.

Costs and Efficiency. The Stoker from an Operating Viewpoint, Robert E. Dillon. Combustion, vol. 7, no. 3, Sept. 1922, pp. 155-157. Consideration of reliability, maintenance, efficiency, cost of operation, and first cost. (Abstract.) Paper presented at Stoker Mfrs. Assn.

Pit-Refuse Utilization. Utilization of Pit Refuse for Raising Steam. Iron and Coal Trades Rev., vol. 105, no. 2839, July 28, 1922, pp. 120-121, 1 fig. Description of Bennis stokers for utilization of pit refuse in use at Gordon House Colliery, Durham, England. Results of tests.

Underfeed, for Low-Grade Fuel. Burning a Low Grade of Fuel on Underfeed Stokers Power, Vol. 56, no. 7, Aug. 15, 1922, pp. 247-251, 8 figs. Description of plant in Minneapolis installed under 5,600-sq. ft. boilers. Tuyeres used to prevent clinker formation and steam jets to mix furnace hases.

STONE

Crushing Plant. A Crushing Plant for a Filter. Rock Products, vol. 25, no. 14, July 25, 1922, pp. 15-17,7 figs. Use for crushed stone which may be developed in many communities where stone can be supplied by commercial producers rather than by municipal plant as in this case. Use offers potential market for large quantities of stone.

STONE, CRUSHED

Plant Engineering. Crushing Plant Engineering, Brownell M'Grew. Eng. and Contracting, vol. 58, no. 7, Aug. 16, 1922, pp. 153-154. Discussion of principles. Paper presented before Nat. Crushed Stone Assn.

STREAM POLLUTION

Natural Purification. De Polluted Streams Purify Themselves? J. H. Hoskins. Fire and Water Eng., vol. 72, no. 8, Aug. 23, 1922, pp. 357-358 and 372, 4 figs. Relation results of natural purification bear to stream pollution. Experiments conducted in Illinois River by U.S. Public Health Service. Agencies active in stream purification.

Pulp-Mill Wastes. Pollution of Streams by Pulp-Mill Wastes, George C. Whipple. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 6, Aug. 1922, pp. 1385-1392. Calls attention to certain fact regarding pulp-mill wastes and discusses briefly larger problem of stream pollution by industrial wastes.

STREET RAILWAYS

Two-Car Train. Two-Car Train Weighs 490 lb., per Seat. Elec. Ry. Jl., vol. 60, no. 10, Sept. 2, 1922, pp. 317-319, 10 figs. Experimental two-car unit, built by Twin City Rapid Transit Co., weighs 51,500 lb. and seats 105 passengers; has low-floor, inside-journal bearings, trucks equipped with band brakes and front car heated with resistors.

STRUCTURES

Excess Loads and Stresses. Unusual Engineering Forces as Design Problems, Chas. Evan Fowler. Eng. and Contracting, vol. 57, no. 26, June 28, 1922, pp. 607-611, 8 figs. Discussion of forces resulting from high winds, storm waves, ice packs or jams, earthquakes and geological changes.

SUBSTATIONS

Automatic. Automatic and Remote Controlled Sub-Stations as Applied to Steel Mills, J. K. Ostrander. Assn. Iron and Steel Elec. Engrs., vol. 4, no. 8, Aug. 1922, pp. 365-379 and (discussion) pp. 379-394. Discusses advisability of installation; economy overhand-operated stations; particular applications to steel-mill operation; equipment required.

Automatic, Mine. Two-Unit Automatic Mine Substation Erected to Improve Service and Reduce Mining Cost, H. F. Randolph and C. E. H. von Sothen. Coal Age, vol. 22, no. 7, Aug. 17, 1922, pp. 244-246, 2 figs. Describes motor-generator automatic substation of Star Coal and Coke Co., Red Star, W. Va.; contains two 150-kw. 500- to 550-v. generators driven by 2,200-v. 3-phase 60-cycle synchronous motors fitted with direct-connected exciters.

SURVEYING

Marine. Marine Surveys, E. Latham and P. Harrison. Engineer, vol. 133, no. 3466, June 2, 1922, pp. 614-615, 7 figs. Deals with leveling, soundings, and current observations.

River Triangulations. Detroit River Triangulations for Fixing Span Length of Detroit-Windsor Bridge, H. F. Johnson. Eng. and Contracting, vol. 59, no. 4, July 26, 1922, pp. 81-82, 6 figs. Describes methods employed in making accurate triangulations connecting angle points of American and Canadian harbour lines.

T

TAPERS

Standard. Standard Tapers, Luther D. Burlingame. A.m Mach., vol. 57, no. 4, July 27, 1922, pp. 130-133, 3 figs. Statement of case for existing standards; suitability of tapers for specific jobs; objections to Jarno taper.

TESTS AND TESTING

Brinell Ball Identation. Some Measurements of the Shape of Brinell Ball Indentation, Fred E. Foss and R. C. Brumfield. Am. Soc. for Testing Matls. advance paper for meeting June 26-30, 1922, 24 pp., 13 figs. Description of methods used in investigation analysis of results obtained and conclusions arrived at.

Methods and Machines. Report of Committee E-1 on Methods of Testing. Am. Soc. for Testing Matls., advance paper meeting June 26-30, 1922, 27 pp., 5 figs. Suggested definitions relating to methods of testing and for verification of testing machines.

THERMIT WELDING

Rails. Development of Thermit Welding (Entwicklungsgeschichte der Thermit-Schienenschweissung und ihre Lehren). Autogene Matallbearbeitung, vol. 15, nos. 12, 13 and 14, June 15, July 1 and 15, 1922, pp. 161-166, 184-188 and 195-197, 12 figs. Methods of welding rails end to end by surrounding joints with liquid thermit mass supplying necessary heat. Apparatus, clamps, ratchet, etc., used.

THERMOMETERS

Specifications. Report of Committee D-15 on Thermometers. Am. Soc. for Testing Matls. advance paper for meeting June 26-30, 1922, 12 pp. Summary of existing specifications, and proposed tentative specifications for A.S.T.M. partial-immersion thermometers.

Transmitting. The "N" and "Z" Transmitting Thermometer. Gas Jl., vol. 159, no. 3087, July 12, 1922, p. 94, 4 figs. Description of thermometer patented by Negretti and Zambra having capillary tube made of high-expansion material.

TILE

Drain. Report of Committee C-6 on Drain Tile. Am. Soc. for Testing Matls. advance paper for meeting June 26-30, 1922, 5 pp. Recommends no changes in standard specifications for drain tile (C4-21).

TIMBER

Douglas Fir. Douglas Fir Invades the East, C. J. Hogue. Elec. Ry. Jl., vol. 60, no. 5, July 29, 1922, pp. 161-163, 2 figs. Range of application of Douglas fir and its comparison with Southern pine; only wood available for large stringers; takes preservatives well.

V

VALVES

Cams and, Behavior of. Cams and Poppet Valves, S. E. Scholes. Gas and Oil Power, vol. 17, no. 203, Aug. 3, 1922, p. 181, 2 figs. Notes on autographic apparatus designed by author for demonstrating valve operation. From paper read before Instn. Automobile Engrs.

VENTILATION

Factory. Modern Factory Ventilation. Eng. Production, vol. 5, no. 100, Aug. 31, 1922, pp. 199-204, 15 figs. Describes plant developed by Ozonair, Ltd., Lond., principal feature of which is impregnation with ozone of all air circulated; also some typical installations.

The Elements of Ventilation in Industrial Works, Frank E. Gooding. Indus. Engr., vol. 80, No. 8, Aug. 1922, pp. 369-377 and 410, 25 figs. Conditions that should be studied when processes are added or changes made.

Katathermometer. Recent Progress of English Investigators in Determining the Relation of Atmospheric Conditions to Fatigue. Heat. and Vent. Mag., vol. 19, no. 8, Aug. 1922, pp. 31-35, 2 figs. What the katathermometer has done in furnishing data for relief of workers in oppressive atmospheres.

VISCOSIMETERS

Redwood. The Redwood Viscometer, Winslow H. Herschel. U.S. Bur. of Standards Technologic Papers, no. 210, Apr. 10, 1922, pp. 227-246, 8 figs. Investigation of two common errors in viscosimetry with following conclusions: that error due to inaccuracy in Meissner formula for average head is negligible in ordinary work; that error due to cooling of oil after leaving outlet tube may be neglected at low temperatures but should be corrected at temperatures near boiling point of water.

W

WAGES

Systems. Wages, Harrington Emerson. Chem. and Met. Eng., vol. 27, no. 9, Aug. 30, 1922, pp. 400-403. Essentials of good wage system, how wages should be measured; how these theories work out in practice illustrated by results obtained in Ford industries.

WASTE HEAT

Utilization. The Utilization of Waste Heat. Mech. Eng., vol. 44, no. 8, Aug. 1922, pp. 513-518, 4 figs. Three papers presented before Lehigh Valley Section of A.S.M.E.: Waste-Heat Boilers, H. B. Smith; Utilization of Waste Heat in the Steel Industry, A. T. Lewis; Utilization of Waste Heat from Rotary Cement Kilns, Joseph Brobston. (Abridgement.)

Utilizing Waste Heat in the Paper Mill, J. O. Ross. Paper, vol. 20, no. 17, June 28, 1922, pp. 7-9. Best forms of machine-room ventilation provide reclamation of waste heat. Read at joint convention of Cost Assn. and Superintendent's Assn.

WATER GAS

Blue Water Gas. Lowe's Plant for the Manufacture of Blue Water Gas in Conjunction with Coal Gas. Gas Jl., vol. 159, no. 3091, Aug. 9, 1922, pp. 324-326, 5 figs. Gives working results of process and details of plant erected at gas works in Auckland, N.Z. Advantages of system.

WATER PIPES

Submerged, Laying. Laying 30-in. Submerged Pipe for Norfolk Water-Works, David A. Decker and John O. Miller. Eng. News-Rec., vol. 89, no. 10, Sept. 7, 1922, pp. 393-395, 4 figs. Integral flexible-joint cast-iron pipe laid from cradle suspended between two barges.

WATER POWER

Paper Industry. Relation of Water Power to the Pulp and Paper Industry in Canada, J. B. Challies and J. T. Johnston. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 6, Aug. 1922, pp. 1403-1407, 1 fig. Importance of industry in Canada; total power installation; electric drive; motive power by Provinces; future power requirements.

WATER TREATMENT

Algae Elimination. Copper Sulphate Treatment for Preventing Algae Growths in Lakes and Reservoirs, N. L. Huff. Can. Engr., vol. 42, no. 9, Aug. 29, 1922, pp. 298-301. There are three classes of fresh-water algae, of which scum formers are most troublesome. Application of copper sulphate and results of treatment.

Prechlorination-Alum. Prechlorination Alum Treatment of Soft Colored Waters, Arthur L. Gammage. Eng. News-Rec., vol. 89, no. 10, Sept. 7, 1922, pp. 391-392. Experiments and seven years' working results show low colored mechanical-filter effluent nearly non-corrosive.

WATER WORKS

Design. Don'ts for Sewerage and Water Works Designers. Pub. Works, vol. 52, no. 25, June 24, 1922, pp. 457-460. Features to be avoided in designing sewerage and water works systems, as set forth by State Board of Health of Minnesota.

WATERPROOFING

Materials for. Report of Committee F-8 on Waterproofing Materials. Am. Soc. for Testing Matls advance paper for meeting June 26-30, 1922, 32 pp., 2 figs. Proposed specifications for asphalt and coal-tar pitch for use in damp-proofing and waterproofing below and above ground level, proposed methods of testing felted and woven fabrics saturated with bituminous substances for use in waterproofing; testing bituminous mastics, grouts and like mixtures; etc.

WATERWAYS

St. Lawrence River. St. Lawrence Waterway is Needed, Anders F. Lindblad. Mar. Rev., vol. 52, no. 8, Aug. 1922, pp. 327-330, 3 figs. Entire country will benefit from providing deep water route from lakes to ocean.

WELDING

Cutting and. Welding and Cutting, F. Horner. Eng. Production, vol. 4, nos. 85, 86, 87, 88, 89, 90 and 91, May 18, 25, June 1, 8, 15, 22 and 29, 1922, pp. 469-473, 487-489, 517-520, 535-538, 565-568, 581-586 and 607-610, and vol. 5, nos. 92, 93, 94, 95, 96 and 97, July 6, 13, 20, 27, Aug. 3 and 10, 1922, pp. 13-17, 37-41, 55-58, 76-82, 112-118 and 133-137, 168 figs. Review of modern methods and appliances.

Forge Welding, Steel for. Steel for Forge Welding, Frank N. Speller. Mech. Eng., vol. 44, no. 7, July 1922, pp. 443-444. Discusses principal factors affecting welding quality af steel, and compares average results of 80 tests made on forge welds of hammer-welded pipe with original material. (Abridgement.)

Problems. Welding Session Develops Salient Facts. Mech. Eng., vol. 44, no. 8, Aug. 1922, pp. 521-523. Gathering under auspices of Am. Welding Soc. and A.S.M.E. Boiler Code Committee emphasizes problems to be met in advancing art of welding.

Tube, Contraction in. Contraction in Tube Welding, Marcel Piette. Welding Engr., vol. 7, no. 8, Aug. 1922, pp. 19-20, 6 figs. Points out that distortion can be avoided by expanding pieces in opposite sense before welding. Translated from Revue de la Soudure Autogène.

See also Electric Welding; Electric Welding, Arc; Electric Welding, Resistance; oxy-Acetylene Welding, Thermit Welding.

WELDS

Testing. Electrical and Magnetic Weld Testing as Applied to Butt-Welded Steel Plates, T. Spooner and I. F. Kinnard. Am. Soc. for Testing Matls. advance paper for meeting June 26-30, 1922, 11 pp., 7 figs. Describes series of laboratory tests applied to are butt-welded steel plates to determine possibility of developing electrical and magnetic tests capable of revealing quality of such welds. See also Iron Age, vol. 110, no. 3, July 20, 1922, pp. 139-141, 6 figs.

WIND TUNNELS

Balances for. The Six-Component Wind Balance, A. F. Zahm. Nat. Advisory Committee for Aeronautics, Report No. 146, 1922, 12 pp., 8 figs. Description of three-dimensional aerodynamic balance capable of rapid and accurate measurement which was installed in 8 by 8 foot tunnel; translation mechanism; measurement of lift, drag, and side drag; rotation mechanism; etc.

WOOD

Fire-Retarding Chemicals for. The Effect of Chemicals on the Ignition Temperature of Wood. W. O. Banfield and W. S. Peck. Can. Chem. and Metallurgy vol. 6, no. 8, Aug. 1922, pp. 172-176, 3 figs. Results of experiments carried out at Univ. of Brit. Columbia. Search for practical fire-retarding chemical.

WOOD PRESERVATION

Aczol for. Aczol—An Interesting Wood Preservative Chem. and Met. Eng., vol. 27, no. 10, Sept. 6, 1922, p. 509. Its ingredients are ammonia, copper, zinc and phenol; successfully used on wood paving.

A.R.E.A. Report. Report of Committee XVII — On Wood Preservation. Am. Ry. Eng. Assn. Bul. vol. 23, no. 245, Mar. 1922, pp. 899-981, 16 figs. Service records; preservative treatment for Douglas Fir, piles and timbers for marine and land structures, methods for storing lumber and piling.

Paint Protection. Paint Protection for Wood, Cornelius T. Myers. Mech. Engr., vol. 44, no. 8, Aug. 1922, pp 519-520 and 545, 2 figs. Notes on moisture in wood and protectiveness of paint. Author points out need for research.

WROUGHT IRON

A.S.T.M. Committee Report. Report of Committee A-2 on Wrought Iron. Am. Soc. for Testing Matls. advance paper for meeting June 26-30, 1922, 3 pp. Proposed revisions of standards and revisions of tentative standards.

Puddling, Mechanical. New Process for Mechanical Puddling. Iron Age, vol. 110, no. 3, July 20, 1922, pp. 143-145, 7 figs. Commercial installation at Titan Works, Newark, N.J., consisting of cupola and ten furnaces. Repeated pourings over a dam the unique principle of new method.

X

X-RAYS

Materials Investigation. The X-Rays and Engineering Investigation, A. Mortimer Codd. Automobile Engr., vol. 12, no. 164, June 1922, pp. 179-181, 7 figs. Discusses apparatus necessary to produce x-rays, and the two methods commonly employed to utilize rays, viz., radiograph and fluroscopy or screening.

Institute Committees for 1922

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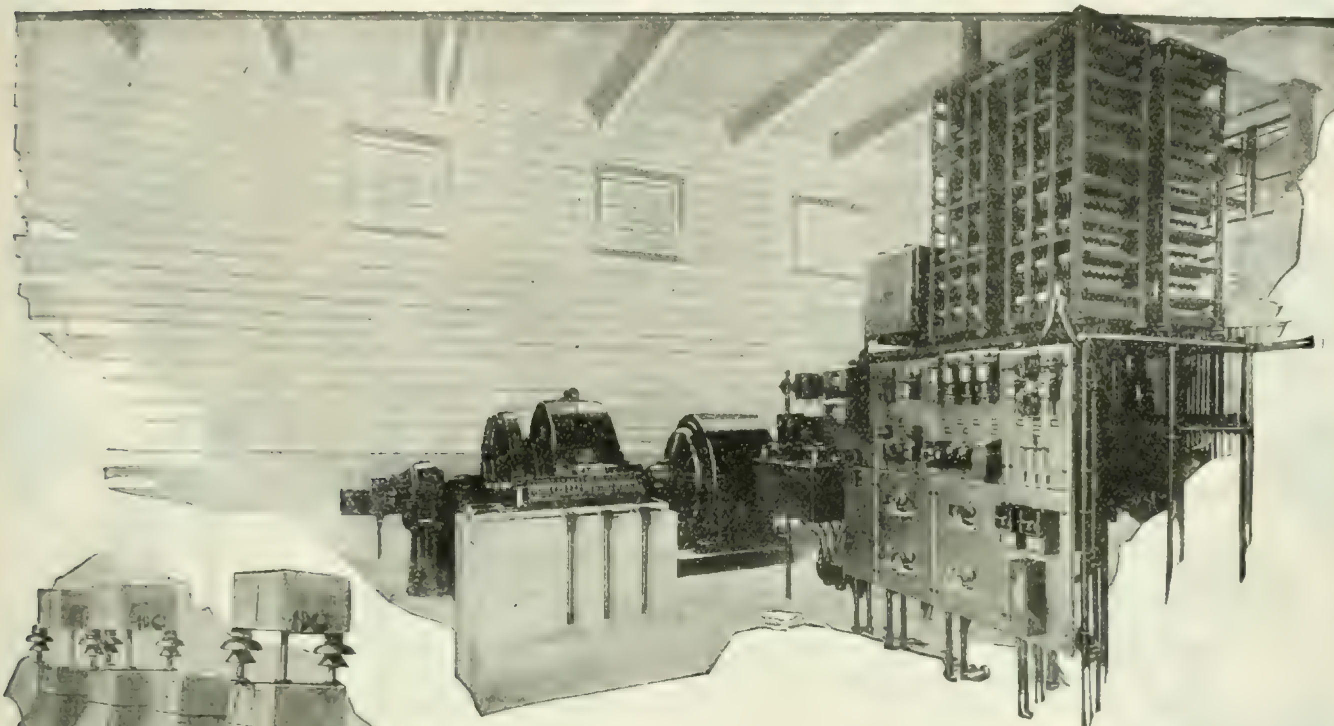

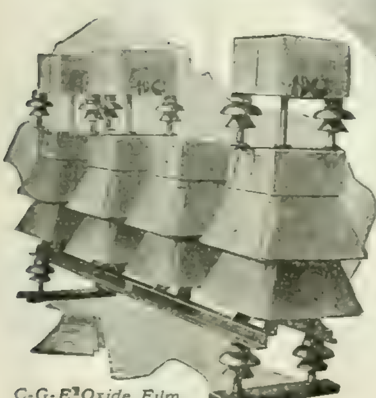

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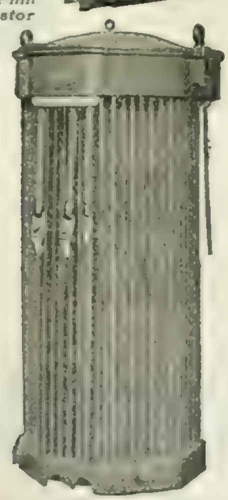

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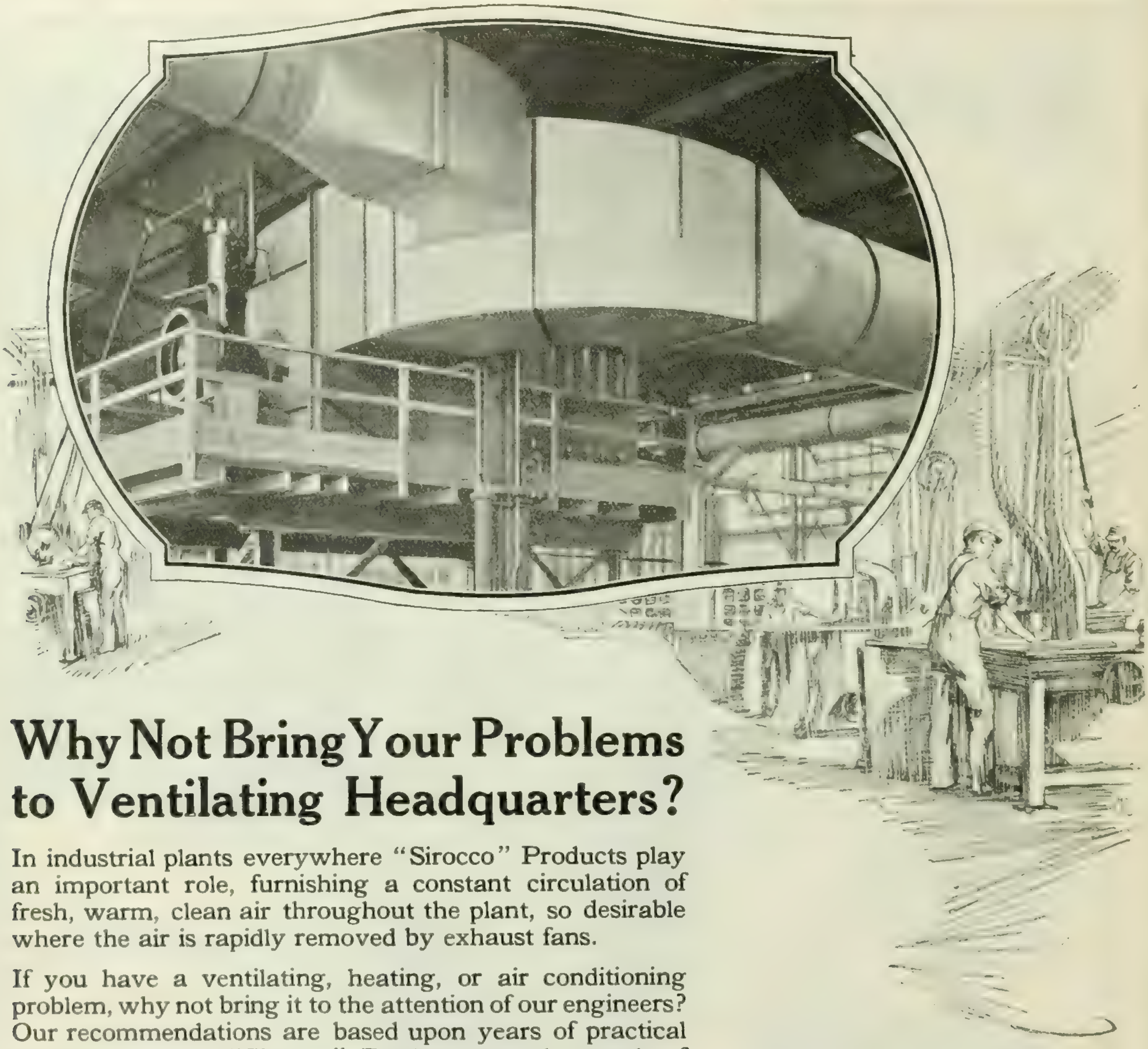

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ACCIDENTS

INDUSTRIAL. Industrial Accidents and Hygiene. Monthly Labor Rev., vol. 15, no. 3, Sept. 1922, pp. 178-195. Problem of dust phthis in granite-stone industry and in printing industry. Heart disease in industry. Safety activity of large motor company. Mine accidents in Alaska, 1921. Fatal accidents in Bulish coal mines 1874-1920.

IRON AND STEEL INDUSTRY. Causes and Prevention of Accidents in the Iron and Steel Industry, 1910-1919, Lucian W. Chaney. U. S. Bur. of Labor Statistics, no. 298, June 1922, 398 pp. 89 figs. Results of study of accidents which have been going on in Bur. of Labor Statistics during last 10 years.

AERONAUTICAL INSTRUMENTS

ALTITUDE. Altitude Instruments. Nat. Advisory Committee on Aeronautics. Aeronautic Instruments, Report No. 126, 1922, 64 pp., 83 figs. Part 1: Altimeters and barographs. Part 11: Precision altimeter design. Part III: Statoscopes and rate-of-climb indicators. Part IV: Aerographs and strut thermometers.

POWER-PLANT INSTRUMENTS. Power Plant Instruments. Nat. Advisory Committee for Aeronautics, Aeronautic Instruments, section 5, report no. 129, 72 pp., 76 figs. Part I: Airplane tachometers. Part II: Testing of airplane tachometers. Part III: Thermometers for aircraft engines. Part IV: Air pressure and oil pressure gages. Part V: Gasoline depth gages and flowmeters for aircraft.

AIR COMPRESSORS

DESIGN. Principles of Design of Air Compressors. William Reavell. Instn. Mech. Engrs. Proc., No. 4, June 1922, pp. 833-854, 15 figs.; also Power House vol. 15, nos. 17 and 18, Sept. 5 and 20, 1922, pp. 22-25 and 22-23, 15 figs. Influence of different types of valves; relation of clearance volume to cylinder volume; efficient cooling; single and multiple-stage compression. Turbo-compressors and their characteristics.

ROTARY. The Planche Rotary Compressor. Engineer, vol. 134. no. 3481, Sept. 15, 1922, p. 280, 7 figs. Describes how compressor of volumetric type and gives particulars of results obtained under test. Translated from Génie Civil.

AIRCRAFT CONSTRUCTION MATERIALS

BRASS, FORGED AND CAST. Investigation of Forged and Cast Brass. Air Service Information Circular, vol. 4, no. 335, Apr. 1, 1922, 6 pp., 8 figs. Investigation to determine suitability of forged brass in gasoline pipe line and tank fittings for service use on airplanes, and to compare soundness of forged and cast brass fittings.

RADIOLOGICAL INSPECTION. Radiological Inspection Work, V. E. Pullin. Aeronautical Jl., vol. 26, no. 144, Sept. 1922, pp. 336-340 and (discussion) 340-348, 11 figs. Shows present position of radiology with regard to its usefulness in according means of inspection of various materials, with special reference to materials and parts used in airplane construction.

AIRPLANES

AEROFOILS. Report of Wind Tunnel Tests on Aerofoils: Dayton-Wright Nos. TT-1 and TT-2, Dayton-Wright Nos. 5 and 6, and Gottingen No. 387. Air Service Information Circular, vol. 4, no. 328, Mar. 15, 1922, 24 pp., 18 figs. Tests of aerofoils to determine lift, drag, L/D center of pressure, and moments about leading edge.

DESIGN. Airplane Design and Performance Improvements Since the Armistice, C. N. Monteith. Soc. Automotive Engrs., Jl., vol. 11, no. 4, Oct. 1922, pp. 320-322. Outline of various features of airplane-development investigation that have been prosecuted. Discusses four specific requirements for increasing speed, rate of climb and ability to reach great altitudes. Notes on variable-area and variable-camber wings; all-metal construction.

PRESSURE DISTRIBUTION. Pressure Distribution Over the Rudder and Fin of an Airplane in Flight, F. H. Norton and W. G. Brown. Nat. Advisory Committee for Aeronautics, Report no. 149, 1922, 9 pp., 10 figs. Investigation carried out to determine leads which occur on vertical tail surfaces under various conditions of flight.

RIBS, TRUSSED. Design of Large Trussed Ribs. Air Service Information Circular, vol. 4, no. 312, Mar. 15, 1922, 17 pp., 10 figs. Describes satisfactory methods of design. Includes appendix in which example is worked out in detail, namely a duralumin trussed rib for 4760-lb. corps observation airplane.

ALLOY STEELS

EXPERIMENTAL PRODUCTION. Experimental Production of Alloy Steels, H. W. Gillett and E. L. Mack. U. S. Bur. of Mines, Bul., no. 199, 1922, 79 pp., 10 figs. Deals with preparation of ingots on any of the series of steels. Describes indirect-arc furnace used in experiments. Photomicrographs.

PHYSICAL PROPERTIES. Standardization of Methods Leading to Comparative Physical Properties of Alloy Steels, R. M. Bird. Am. Soc. for Steel Treating, Trans., vol. 2, no. 12, Sept. 1922, pp. 1213-1218, 15 figs. Describes procedure adopted at Bethlehem plant of Bethlehem Steel Co. which is said to yield more truly comparable results than previous systems.

ALLOYS

ALUMINUM. *See Aluminum Alloys.*

BEARING METALS. *See Bearing Metals.*

NICKEL. *See Nickel Alloys.*

SHRINKAGE-TESTING APPARATUS. New Forms of Apparatus for Determining the Linear Shrinkage and for Bottom-Pouring of Cast Metals and Alloys, Accompanied by Data on the Shrinkage and Hardness of Cast Copper-Zinc Alloys, F. Johnson and W. Grantley Jones. Inst. Metals advance paper for meeting Sept. 20-22, 1922, 28 pp., 11 figs.

STUDY OF. The Art of Alloying, W. Guertier. Brass World, vol. 17, nos. 8 and 9, Aug. and Sept. 1922, pp. 229-234 and 257-259, 10 figs. Method of production by fusion of technically possible and impossible alloys. Account of mixed crystal formations and their importance. Description of appearance of compounds and their effects. Physical properties as affected by increasing miscible ratios. Chart for constructive purposes and design of utilizable alloys. Translated from Zeit. fr Metalkunde, no. 9, June 1921.

WHITE METALS. White Metals, A. H. Mundey. C. C. Bissett and J. Cartland. Inst. Metals advance paper for meeting Sept. 20-22, 1922, 25 pp. 10 figs. Review of principal classes of white metals, their composition and physical properties, chiefly in relation to their uses and manufacture. Deals with anti-friction alloys and other white metals, Photomicrographs. See also Engineering, vol. 114, no. 2962, Oct. 6, 1922, pp. 411-443, 10 figs.

ALUMINUM

OVERHEATING, EFFECTS OF. The Effects of Over-Heating and Repeated Melting on Aluminum. W. Rosenhain and J. D. Crogan. Inst. Metals advance paper for meeting Sept. 20-22, 1922, 11 pp., 3 figs. Investigation to determine whether certain forms of treatment in melting and remelting of aluminum would bring about in metal deterioration approximating condition generally described as "burnt" aluminum. Part of research carried out for Aeronautics Research Committee. See also Engineering, vol. 114, no. 2961, Sept. 29, 1922, pp. 414-415, 3 figs.

ALUMINUM ALLOYS

ALUMINUM-COPPER. The Copper-Rich Aluminum-Copper Alloys, David Stockdale. Inst. Metals advance paper for meeting Sept. 20-22, 1922, 14 pp., 37 figs. Two general methods of making investigations were used — the taking of cooling curves and micro-examination of quenched specimens. See (abstract) in Engineering, vol. 114, no. 2961, Sept. 29, 1922, pp. 396-398, 7 figs.

ALUMINUM-SILICON. Properties and Manufacture of Aluminum-Silicon Alloys, Junius D. Edwards. Chem. & Met. Eng., vol. 27, no. 13, Sept. 27, 1922, pp. 654-655, 1 fig. Presents values for number of physical properties of aluminum-silicon alloys, pertinent to their commercial application.

ANALYSIS. The Complete Analysis of Aluminum Alloys, E. W. Sheel. Metal Industry (Lond.), vol. 21, no. 9, Sept. 1, 1922, pp. 193-194. Describes process which has been used in laboratory under author's supervision, and with which he claims to have obtained excellent results. Determination of silicon, copper, tin, zinc, magnesium, iron, manganese and nickel.

CASTINGS. Inclusions in Aluminum-Alloy Sand Castings, R. J. Anderson. U. S. Bur. of Mines, Tech. Paper, no. 290, 1922, 25 pp., 23 figs. Investigation of hard spots in connection with Bureau's work on casting losses in aluminum-alloy foundry practice. Notes on experiences at foundries; kinds and characteristics of hard spots, causes and factors affecting occurrence, composition and identification. Photomicrographs.
See also Duralumin.

AMMONIA

COAL, RECOVERY FROM. Ammonia from Coal, John W. Cobb. Fuel in Sic. & Practice, vol. 124, no. 3221, Sept. 22, 1922, pp. 167-174, 6 figs. Review of development and experiments. Author deals briefly with so-called synthetic process.

SPECIFIC HEAT. Measurement of Specific Heat of Superheated Ammonia, E. E. Mueller. Refrig. Eng., vol. 9, no. 1, July 1922, pp. 1-3, 4 figs. Results of measurements to determine specific heat at constant pressure to an accuracy comparable with other total heat elements already determined, namely, latent heat of vaporization and specific heat of liquid.

AMMONIA COMPRESSORS

FEATHER-VALVE. Feather Valve Compressors of Three Types, Construction and Operation, F. L. Fairbanks. Refrig. Eng., vol. 9, no. 3, Sept. 1922, pp. 85-90 and (discussion) 90-92, 94, and 101-102, 11 figs. Test data of Boyle compressor, alone, Boyle compressor with booster, motors-driven compressor, and uniflow steam-engine-driven compressor.

AMMONIA CONDENSERS

LARGE The Advantages of a Large Ammonia Condenser, L. C. Miller. Power, vol. 56, no. 15, Oct. 10, 1922, pp. 568-570. Includes tables showing capacity of double-pipe condensers. Operating with high pressures.

ARCHES

CONCRETE-GROINED. The Comparison of Concrete Groined Arches as an Aid in Their Design, Philip O. Macqueen. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 8, Oct. 1922, pp. 1665-1671, 4 figs. Study of proportions of typical concrete groined arches which have been used successfully for reservoir roofs.

ARMATURES

WINDING D. C. Some Ways to Locate and Remove Troubles. When Winding D. C. Armatures, Marin Phillips. Indus. Engr., vol. 60, no. 9, Sept. 1922, pp. 435-441 and 458, 5 figs. What tests to make and some practical hints on correct methods of winding and connecting coils so as to prevent trouble with details of how to remedy defects which may develop.

ASPHALT

INDUSTRY. Development of the Asphalt Industry in the United States, Provost Hubbard. Can. Engr., vol. 43, no. 12, Sept. 19, 1922, pp. 365-366. Varieties and tonnages of asphalts imported; growth of petroleum asphalt industry; properties and uses.

AUTOMOBILE ENGINES

AIR-COOLED. Air Cooled Engines Not Inherently More Economical, A. Ludlow Clayden. Automotive Industries, vol. 47, no. 12, Sept. 21, 1922, pp. 569-570. Maximum desirable mean cylinder temperature not known. Lack of data on this and other factors accounts largely for numerical superiority of designs using water cooling. Data on area of cooling fins.

CYLINDERS. *See Cylinders, Machining*

IGNITION *See Ignition*

PISTON PINS. Tubing vs. Solid Stock as Material for Piston Pins, C. B. Fraser. Automotive Industries, vol. 47, no. 15, Oct. 12, 1922, pp. 713-719. Comparison of manufacturing costs difficult. Experience shows solid stock cheaper in small pins. No difference in quality when same grade of steel is used.

AUTOMOBILE FUELS

ALCOHOL. Motor Tests with Alcohol, Roy Alden. Oil News, vol. 10, no. 17, Sept. 5, 1922, p. 37. Exhaustive tests in India on single-cylinder engine show alcohol makes better motor fuel than gasoline; detonation eliminated. (Abstract.) Report of Imperial Motor Transport Council of India.

VAPORIZATION. Vaporization of Motor-Fuels, P. S. Tice. Soc. Automotive Engrs. Jl., vol. 11, no. 4, Oct. 1922, pp. 307-314 and (discussion) 314-319 and 332, 7 figs. Summary of conditions surrounding and controlling fuel vaporization in cycle of operation of throttle-controlled internal-combustion engines, fitted with intake manifold and carburetor.
See also Gasoline.

AUTOMOBILES

SUSPENSIONS. The Problem of Suspension, Louis Coatalen. Autocar, vol. 49, no. 1405, Sept. 22, 1922, pp. 537-541, 3 figs. Describes simple but ingenious method of ascertaining spring action, which may lead to extremely important results.

TECHNICAL STUDIES. Studies of the Automobile, G. B. Upton. Sibley Jl., vol. 35, nos. 4.5.6 and 9.10, Apr., May-June and Sept.-Oct. 1921 and vol. 36, nos. 4, 5 and 6, Apr., May and June 1922, pp. 58-60 and 71, 80-81 and 10, 120-124, 58-65 and 74, 78-90 and 100, and 108-118, 17 figs. Apr.: Past- and problem of present time. May-June: Load-carrying capacity of tires on hard roads. Sept.-Oct.; Tractive resistances of sand and soft soils. Apr., May and June; Power required to run a car.

TRANSMISSIONS. New Electric Transmission Provides for Direct Drive. Automotive Industries, vol. 47, no. 15, Oct. 12, 1922, pp. 711-714, 5 figs. Sperry transmission has five speeds forward, two in reverse and electric braking. Direct drive obtained by automatic, electrically operated friction clutch.

AVIATION

CANADA. Some Technical Aspects of Aviation in Canada, E. W. Stedman. Aeronautical Jl., vol. 26, no. 141, Sept. 1922, pp. 349-375, 24 figs. Discusses different kinds of work that can be carried out by aircraft in Canada; country to be traversed; type of machine; winter flying; engine cooling, lubrication and starting propellers; protection of crew; temperature effects on rigging and instruments; [illegible]ing on snow.

AXLES

MANUFACTURE. Manufacturing Car and Locomotive Axles, Nathan S. Frohman. Am. Mach., vol. 57, no. 13, Sept. 28, 1922, pp. 473-477, 11 figs. Steel specifications and machining operations; inspection and tests; forging under hydraulic presses; hollow boring and heat treating. Methods employed by Pollak Steel Co.

B

BALANCING MACHINES

ROTATIVE BODIES. New Principles in Rotative Balance, Amos F. Moyer. Soc. Automotive Engrs. Jl., vol. 11, no. 4, Oct. 1922, pp. 368-372, 9 figs. Describes balancing machine by B. L. Newkirk, of research department of Gen. Elec. Co., for measuring directly resultants for two separate ends of rotative body, without necessity of separating the standing from running balance.

BEARING METALS

GENELITE. Genelite — A New Bearing Material, E. G. Gilson. Machy. (N. Y.), vol. 29, no. 2, Oct. 1922, pp. 123-124, 2 figs. Bronze material containing graphite evenly distributed throughout entire mass.

BEARINGS

ANTI-FRICTION. New Anti-Friction Bearings. Times Trade & Eng. Supp., vol. 11, no. 220, Sept. 23, 1922, p. 41, 1 fig. Describes new form of bearing invented by German engineer which is being introduced on large scale for industrial and railway purposes; consists of white metal in which special stones are embedded.

BEARINGS, BALL

ADVANTAGES AND APPLICATIONS. Ball Bearings Their Advantages and Principal Applications in Brazil (Os mancaes de espheras, suas vantagens e principaes applicaces no Brazil), Leopoldo Franca. Revista Brasileira de Engenharia, vol. 4, no. 1, July 1922, pp. 18-24, 8 figs. Stribeck and SKF types; reducing accidents. etc.

ROLLER AND. Ball and Roller Bearings With Details of Their Installation, C. A. Van Brunt. Indus. Engr., vol. 80, no. 9, Sept. 1922, pp. 420-429 and 459-460, 34 figs. The various designs and construction and directions for installing them on lineshafts and machines.

BEARINGS, ROLLER

CONTACT TYPE. Rolling Contact Bearings, Tobias Dantzig. West. Machy. World, vol. 13, nos. 6 and 7, June and July 1922, pp. 216-217, 247-248. Classification of anti-friction bearings; ideal bearing, efficiency and capacity. Principles of design and construction.

ROLLER INSPECTION. Inspecting Bearing Rollers by Machine. Machy. (N. Y.), vol. 29, no. 2, Oct. 1922, pp. 94-95, 3 figs. Describes machine developed by Bock Bearing Co., Toledo, O., which automatically inspects and sorts rollers at rate of 3000 per hr.

TAPERED. Can Tapered Roller Bearings be Run at High Speeds. T. V. Buckwalter. Machy. (N. Y.), vol. 29, no. 2, Oct. 1922, p. 107. Results obtained in running tapered roller bearings economically and efficiently at speeds exceeding 10,000 r.p.m.

BELT DRIVE

MAINTENANCE-COST REDUCTION. Overcoming Heavy Costs of Belt Maintenance, J. H. Rodgers. Power House, vol. 15, nos. 13 and 14, July 5 and 20, 1922, pp. 29-31 and 21-22 and 24, 11 figs. Transmission problems should be in charge of competent man; inspection should be made regularly; importance of proper alignment; lacing of joints should be carefully performed.

BLAST-FURNACE GAS

TREATMENT. Blast Furnace Gas. Gas & Oil Power, vol. 17, nos. 203 and 204, Aug. 3 and Sept. 7, 1922, pp. 179-180 and 197-198, 3 figs. Its treatment for use with gas engines.

BLAST FURNACES

ELECTRIC-POWER APPLICATION. Utilization of Electric Power About the Blast Furnace, Gordon Fox. Elec. Jl., vol. 19, no. 9, Sept. 1922, pp. 369-371, 3 figs. Deals with application of electric power to blowing, pumping, material handling and accessories.

MODERN PRACTICE. The Bases of Modern Blast-Furnace Practice, A. K. Reese. Engineering, vol. 114, no. 2958, Sept. 8, 1922, pp. 312-316, 2 figs. Writer discusses four prime factors in modern blast-furnace practice, namely, (1) preparation of materials; (2) furnace design; (3) auxiliary equipment; and (4) method of operation. Paper read before Iron & Steel Inst.

BOILER FEEDWATER

ANALYSIS AND PURIFICATION. Rapid Analysis, Purification and Control of Industrial Waters (Analyse rapide, épuration et contrôle des eaux industrielles). P. de Vadder. Outillage, vol. 6, no. 39, Sept. 30, 1922, pp. 1280-1282. Analysis, of boiler feedwater; temporary and permanent hardness; water softening.

DEGASIFICATION. Corrosion — Its Cause and Cure. Power, vol. 56, no. 14, Oct. 3, 1922, pp. 532-533, 2 figs. Discusses corrosion as found in power plants and describes Kestner process and degasser, as example of European corrosion method of removing oxygen from boiler feedwater.

The Degasification of Boiler Feedwater, J. R. McDermet. Mech. Eng., vol. 44, no. 10, Oct. 1922, pp. 648-650, 7 figs. Fundamental laws governing separation of dissolved gases from water by air-tension control, and extent of their application to conventional types of feedwater-heating equipment.

TREATMENT. Corrosion of Walls in Steam Generators (Intorno alle corrosioni delle pareti interne dei generatori di vapore), Giuseppe Gianoli. Industria, vol. 36, no. 14, July 31, 1922, pp. 261-262. Tests made by Rauch on effect of sodium chromate and bichromate on feedwater.

Extensive Boiler-Water Treating on C. M. & St. P. Ry., C. Herschel Koyl. Eng. News-Rec., vol. 89, no. 14, Oct. 5, 1922, pp. 560-562, 4 figs. Chemical treatment in bad-water district improves operating conditions. Savings soon pay for numerous plants.

Solving the Feed-Water Problems at New Orleans, O. P. Adams and Paul F. Hoots. Power, vol. 56, no. 16, Oct. 17, 1922, pp. 596-599, 2 figs. The 50,000-kw. plant of New Orleans Railway & Light Co., uses Mississippi River water for makeup with practically no trouble from scale or priming, although boilers operate at high rating. This is accomplished by lime-soda-copper as treatment in steam-heated tank and by using periodic water tests.

BOILER OPERATION

Fuel Burning and. The Economic Operation of Boilers and Burning of Fuels. Frank G. Parker. Pacific Mar. Rev., vol. 19, no. 10, Oct. 1922, pp. 564-567. Analysis of heat transfer problems and of combustion factors governing furnace tube and stack design. Paper read before Am. Soc. Mar. Engrs.

Low-Draft Maintenance. The Draft Over the Fire, E. M. Eliot. Power, vol. 56, nos. 12 and 14, Sept. 19 and Oct. 3, 1922, pp. 446-448 and 523-526, 5 figs. Sept. 19: Importance of maintaining constant low draft over fire in case of boilers operating under forced draft. Oct. 3: How to find actual saving obtainable by various methods of maintaining it.

BOILER PLANTS

Heppenstall Co., Pittsburgh. Modern Steam Generating Plant, R. F. Keifer. Blast Furnace & Steel Plant, vol. 10, Oct. 1922, pp. 509-519, 8 figs. Details of boiler plant of Heppenstall Forge & Knife Co.; description of building, coal bunker; coal-handling equipment; coal crusher; boilers; feedwater pumps and treatment.

BOILERS

Bent-Tube vs. Straight-Tube. Bent Tube vs. Straight Tube Boilers, Walter N. Flanagan. Assn. Iron & Steel Elec. Engrs., vol. 4, no. 7, July 1922, pp. 321-343 and (discussion) pp. 344-355, 12 figs. Presents principles involved in selection and observations of author.

Calculation. Application of Stefan's Law to Boiler Calculation (Aplicactión de la ley de Stefan al calculo de calderas), Vicente Burgaleta. Anales de la Associación de Ingenieros del Instituto Católico de Artes e Industrias, vol. 1, no. 1, Jan. 1922, pp. 39-45, 5 figs. Advocates its substitution for formulas formerly used; application to locomotives, etc.

High Pressures. Very High Pressures in Modern Practice. Power Houses, vol. 15, no. 19, Oct. 5, 1922, pp. 23-24, 1 fig. Central station of public-service company uses boiler pressure of 400 lb. per sq. in., marking new advance in engineering practice on American continent.

Waste-Heat. British Practice in Waste Heat Utilization, C. H. S. Tupholme. Power Plant Eng., vol. 26, no. 20, Oct. 15, 1922, pp. 994-996, 2 figs. Information on waste-heat boilers, including details of new improved Spencer-Hopwood deep-nest boiler and new Kirke patent gas-fired boiler. Uses for gas-fired boiler.

BORING MACHINES

Automatic. Automatic Boring and Facing Machine. Machy. (Lond.), vol. 20, no. 522, Sept. 28, 1922, pp. 787-790, 7 figs. Details of machine developed by Butterworth & Co. for automatically performing boring, facing and similar turning operations that can be confined to tools mounted in a turret heat.

BRASS

Hardness. The Hardness of the Brasses, and Some Experiments on Its Measurement by Means of a Strainless Indentation, F. W. Harris. Inst. Metals advance paper for meeting Sept. 20-22, 1922, 27 pp., 12 figs. Tests to determine position of hardness-composition curve at certain points in phase field.

BRIDGE ERECTION

Cold-Weather Concreting. Building a Five Span Concrete Bridge in Cold Weather, G. F. Scales. Eng. News-Rec., vol. 89, no. 14, Oct. 5, 1922, p. 563, 1 fig. Manure protection raised temperature during first 72 hours. Simple but effective methods used in placing protection.

BRIDGES

Specification for Girder. Girder Bridges. British Eng. Standards Assn., no. 153, July 1922, 37 pp., 8 figs. British standard specification for materials and workmanship.

Transporter, Buenos Aires. Riachuelo Transporter Bridge, Buenos Aires, J. P. Risdon. Engineering, vol. 114, nos. 2955, 2956, 2958, 2960 and 2962, Aug. 18, 25, Sept. 8, 22, and Oct. 6, 1922, pp. 193-196, 22 figs. partly on supp. plate; 227-228, 29 figs. partly on supp. plate and p. 238; 287-290, 67 figs. partly on supp. plate; 354-356, 12 figs.; and 424-427, 2 figs. Object of bridge is to facilitate heavy road traffic to Buenos Aires Southern Dock; its provides for clear width of waterway of 175 ft. 6 in.; span is 254 ft. 3 in.; overall length of superstructure, 300 ft. 9 in. Car is suspended by rigid, trussed frame of light design, from overhead trolley bogies running upon rails supported on special rail bearer girders.

BRIDGES, CONCRETE

Falsework for Arch. Special Trussed Falsework for Concrete Arch, Merrill Butler. Eng. News-Rec., vol. 89, no. 12, Sept. 21, 1922, pp. 468-469, 3 figs. Design made in attempt to do away with support to river bed subsequently provided with supporting tower.

Beams, Load Distribution. Distribution of Load Between Beams in Reinforced-Concrete Bridges (La répartition des charges entre les poutres dans les ponts en beton armé), Maximilien Thullie. Génie Civil, vol. 81, no. 8, Aug. 19, 1922, pp. 174-178, 14 figs. Calculation; examples in determining influence lines.

BRIDGES, RAILWAY

Design. Present-Day Problems and Tendencies in Railway Bridge Design, Conrad Gribble. Engineering, vol. 114, no. 2958, Sept. 8, 1922, pp. 307. Discusses problem of secondary stresses, rivets and problems arising out of railway amalgamations. Paper read before Brit. Assn.

Strength. The Strength of Railway Bridges, A. C. Cookson and J. S. Nicholas. Engineering, vol. 114, no. 2958, Sept. 8, 1922, pp. 293-296, 9 figs. With special reference to proposals of Ministry of Transport. Paper read before Brit. Assn.

BRUSHES

Carbon. Parallel Sided Carbon Brushes for D. C. Commutator Machines. British Eng. Standards Assn., No. 96, July 1922, 8 pp., 2 figs. British standard specification.

BUSES

Design. Some Fundamental Characteristics of Present-Day Buses, R. E. Plimpton. Soc. Automotive Engrs. Jl., vol. 11, no. 2, Aug. 1922, pp. 163-172, 12 figs. Enumeration of distinctive features of buses designed for city, inter-city and country service. Discussion of steam and electric motive power, chassis components for bus service, types of bus body, problems of heating, lighting and ventilation, fare-collection devices, etc.

See also Motor Buses

C

CABLES, ELECTRIC

Steel-Aluminum. Steel Aluminum for Overhead Lines (Stahlaluminium für Freileitungen), Hch. Schenkel. Elektrotechnische Zeit., vol. 43, no. 37, Sept. 14, 1922, pp. 1153-1156, 2 figs. Investigations show effect of temperature on distribution of forces in the two metals. It is shown that steel-aluminum cable possesses certain advantages over copper.

CABLES, HOISTING

Rubber-Covered vs. Braided. Rubber-Covered vs. Braided Cable for Mine Work. Coal Age, vol. 22, no. 15, Oct. 12, 1922, pp. 583-586, 5 figs. Report of Committee on all-rubber-insulated as compared with ordinary braid-covered cables for portable extensions, locomotive cable and mining-machine cable, presented before W. Va.-Ky. Assn. Mine. Mech. & Elec. Engrs. Engineers detail experience with machine cable, resistors and insulating oils.

CANALS

Locks. The Meuse Lock on the Meuse-Waal Canal, L. R. Rentholt. Engineer, vol. 134, no. 3480 and 3481, Sept. 8 and 15, 1922, pp. 235-238, and 261-264, 15 figs. Details of design and construction. Largest vessels for which lock has been built are of from 2000 to 2400 tons carrying capacity; total length, 1100 ft.; useful length, 860 ft.; width, 52 ft. 6 in.; depth on sills, 12 ft. 6 in. below low water.

CABLEWAYS

Gilboa Dam. Aerial Tramways Serve Mixing Plant at Gilboa Dam, Charles K. Traber. Eng. News-Rec., vol. 89, no. 15, Oct. 5, 1922, pp. 604-606, 4 figs. Rugged country makes surface roads difficult. Air lines reliable and cost less. Lines have surplus capacity. Operation undisturbed by rain or snow.

CARS

Oscillation-Recording Instrument. Oscillation Recording Instruments in Use on the Great Northern Railway. Ry. Gaz., vol. 37, no. 10, Sept. 8, 1922, pp. 314-316, 8 figs. Details of device known as "Enregistreur Hallade," and illustration of records made therewith.

Recording Riding Qualities of Cars, F. Crocker. Ry. Rev., vol. 71, no. 14, Sept. 30, 1922, pp. 437-439, 12 figs. Describes instrument devised by author for recording oscillations. Investigation conducted on English railway equipment of car-riding qualities.

CARS, FREIGHT

Steel. The Design of Modern Steel Freight Car Equipment, John A. Pilcher. Ry. Rev., vol. 71, no. 15, Oct. 7, 1922, pp. 467-475, 7 figs. General principles that should govern in steel freight car design; suggestions for improving certain features in design; continual addition of material to enable cars to withstand rough handling detracts from earning power. Paper read before Ry. Club of Pittsburgh.

CARS, PASSENGER

Heating. A Thermostatic Control of Car Heating. Ry. & Locomotive Eng., vol. 35, no. 9, Sept. 1922, pp. 234-236, 8 figs. Electrothermostatic control developed by Vapor Car Heating Co., Chicago, principle of which consists in use of electric current whose circuit is made or broken by thermometer placed in car to regulate flow of steam to heating pipe.

CASE-HARDENING

Carburizing and Decarburizing. Carburizing and Decarburizing in Case Hardening, H. B. Knowlton. Am. Soc. for Steel Treating Trans., vol. 2, no. 12, Sept. 1922, pp. 1155-1166, 16 figs. Discussion of carburizing and decarburizing actions which make for success or failure of case-hardening method in commercial practice. Photomicrographs.

Failures Due to Improper Steel. Irregularities in Case Hardened Work Caused by Improperly Made Steel, E. W. Ehn. Am. Soc. for Steel Treating Trans., vol. 2, no. 12, Sept. 1922, pp. 1177-1202, 55 figs. Gives experiences which are results of research work during last few years in metallurgical department of the Timken Roller Bearing Co. Photomicrographs.

Materials for, Tests of. Tests of Carburizing Materials, O. A. Knight and T. C. Kern. Forging & Heat Treating, vol. 8, no. 9, Sept. 1922, pp. 420-425. Results of exhaustive series of tests on five commercial compounds, indicating decided superiority of one.

CAST IRON

Growth during Repeated Heatings. On the Growth of Gray Cast Iron during Repeated Heatings and Coolings, Tario Kikuta. Science Reports of Tôhoku Imperial Univ., 1st series, vol. 11, no. 1, Apr. 1922, pp. 1-17, 16 figs. partly on supp. plates. Three periods of growth: (1) due to decomposition of cementite; (2) due to resisting effect of gas pressure to contraction; (3) yielding to pressure of occluded gases at high temperatures. 57th Report of Iron & Steel Research Inst.

Tensile Tests. Tensile Tests of Cast Iron at Various Temperatures, J. F. Harper and R. S. Mac Pherran. Iron Age, vol. 110, no. 13, Sept. 28, 1922, pp. 793-794, 5 figs. Results of work done on annealed bars in special apparatus. Comparison with steel under similar conditions.

CASTING

Centrifugal. Chromium Alloy Steel Cast Centrifugally, L. Cammen, Iron Age, vol. 110, no. 11, Sept. 14, 1922, p. 655, 1 fig. Annealed, it has same structure as mechanically worked metal, from ingots cast in stationary molds; dendritic structure absent and grain structure small.

McConway Centrifugally Cast Steel. Foundry Trade Jl., vol. 26, no. 319 Sept. 28, 1922, pp. 257-258, 1 fig. Describes new process for production of steel disks by centrifugal and hydraulic methods direct from molten steel.

CASTINGS

Silicon-Iron. Silicon-Iron Acid-Resisting Castings, Wm. Mason. Metal Industry (Lond.), vol. 21, no. 14, Oct. 6, 1922, pp. 323-325, 6 figs. Discusses nature and uses of silicon-iron acid-resisting alloys, extensive substitution of parts made of it for earthenware in chemical plant, and scope for manufacture of castings.

CELLULOSE

Wood and Cotton. Comparison of Wood Cellulose and Cotton Cellulose, S. A. Mahood and D. E. Cable. Jl. Indus. & Eng. Chem., vol. 14, no. 8, Aug. 1922, pp. 727-731. Data recorded show that wood cellulose most nearly corresponding to cotton, taking purified linters as standard, is obtained by recooking "easy bleaching" sulphite pulp with soda and bleaching with 2 per cent bleach.

CEMENT GUN

Fire Tests. Fire Tests of Gunite Walls Eng. and Contracting, vol. 58, no. 13, Sept. 27, 1922, p. 292. Results of tests. (Abstract.) Report of Underwriters' Laboratories, Chicago

CEMENT MANUFACTURE

Iron and Steel, Application of Iron and Steel and Their Application in the Cement Industry, W. R. Shimer. Contract Rec., vol. 36, no. 35, Aug. 30, 1922, pp. 862-865. Notes on obtaining steel at suit purpose. Reasons for failure of steel under certain conditions. Co-operation of cement engineer and steel-plant metallurgist advocated. Paper read before Portland Cement Assn.

CENTRAL STATIONS

Solar-Heat. Solar Heat Central Stations (Centrali elettriche ad energia solare), Carlo Boggia. Industria, vol. 36, no. 13, July 15, 1922, pp. 245-246. Describes method depending on operating turbine with CO_2 from generator heated by sun.

Superpower. The Gennevilliers Electric Power Station. Engineer, vol. 134, nos. 3480, 3481 and 3482, Sept. 8, 15, and 22 1922, pp. 242-243, 1 fig.; 270-272, 7 figs. and 294, 4 figs. on supp. plate. Full description of station, including particulars of Babcock boilers; electric plant and equipment; buildings; etc.

CHIMNEYS

Calculation. Chimney Calculation (Schornsteinberechnung), H. de Grahl. Glasers Annalen, vol. 91, no. 4, Aug. 15, 1922, pp. 54-56 and (discussion) 56-62, 3 figs. Includes table showing comparison of 11 different calculating methods. Hoffman's calculating method and values obtained.

CHROMIUM STEEL

Hardness. Variation of Hardness in Chromium Steels (Härdhetens voriation med värmebehandlingen hos ett kromstal), H. Rowsing and J. Sissener. Jerknontorets Annaler, vol. 107, no. 8, 1922, pp. 382-386, 8 figs. Discusses recent experiments of Portevin and Chevenard.

COAL

Carbonization. Decomposition Processes Applicable to Certain Products of Coal Carbonization, M. J. Bradley. Chem. and Met. Eng., vol. 27, no. 15, Oct. 11, 1922, pp. 737-744, 3 figs. Experimental study in which mixed zylenes were decomposed under varied conditions of temperature, pressure and atmosphere. Effects of different contact surfaces. Identification of many of important decomposition products. (Abstract.) Work carried out at University of Ill.

COAL INDUSTRY

Canada. The Development of the Coal Industry in Canada, F. W. Gray. Can. Inst. Min. and Metallurgy Monthly Bul., no. 126, Oct. 1922, pp. 1051-1069. Notes on anthracite and bituminous supply and demand; Nova Scotia coal; western coal; fuels and sources of power other than coal.

Patent-Fuel Manufacture. Notes on Patent Fuel, Arthur Grounds. Fuel in Sci. & Practice, vol. 124, nos. 3213, 3214 and 3221, July 28, Aug. 25 and Sept. 22, 1922, pp. 119-122, 149-151 and 174-177. July 28: Deals with various binding materials proposed as suitable for agglomeration of fine coal for manufacture of briquettes and ovoid fuel. Aug. 25: Selection of coals for briquetting and grinding of coal and pitch. Sept. 22: Research on manufacture of briquettes.

COAL MINES

Surveying. Surveying Steep Workings with Mining Dials, T. G. Bocking. Colliery Guardian, vol. 124, no. 3219, Sept. 8, 1922, p. 579, 4 figs. Describes Bocking-Owen auxiliary sight for making surveys in coal-mine workings having inclinations up to 75 deg.

COKE OVENS

By-Product. Great Western Colliery Company, Limited. Gas World, vol. 77, no. 1989, Sept. 2, 1922, pp. 12-16, 7 figs. Details of new by-product coke-oven plant.

COLD STORAGE

Freezing Point of Fruits and Vegetables. Freezing Points of Fruits and Vegetables, D. B. Carrick. Ice and Refrigeration, vol. 63, no. 4, Oct. 1922, pp. 180-181. Results of investigations conducted to determine freezing point and freezing injury; description of apparatus and methods used; conditions under which experiments were conducted; data obtained on apples and potatoes.

Humidity Control. Humidity Control in Cold Storage Warehouses, Milton W. Browne. Ice and Refrigeration, vol. 63, nos. 3 and 4, Sept. and Oct. 1922, pp. 140-142 and 181-183, 2 figs. Is as important as temperatures in handling of fruits and [illegible] storage, heating capacity of air depends upon quantity of water vapor mixed with it; absolute and relative humidity; humidity temperature and dewpoint effect; relative humidity, hygrometrical and conversion tables.

COMPRESSED AIR

Reheating. The Reheating of Compressed Air, C. R. Richards and J. N. Vedder. University of Ill., Bul., vol. 19, no. 41 (bul. no. 130), June 5, 1922, 88 pp. 22 figs., 12 tables. Investigation undertaken to determine thermodynamic efficiencies resulting from heat expended in reheating process, efficiency of external and internal combustion [illegible] using air expansively under wide variety of operating [illegible], performance of same engine operating with steam alone, and with mixtures of air and steam.

CONCRETE

Permeability-Testing Apparatus. High-Pressure Apparatus for Testing Permeability of Concrete (Appareil à haute pression pour l'étude de la perméabilité du beton), W. Hugentobler. Bul. Technique de la Suisse Romande, vol. 48, no. 19, Sept. 16, 1922, pp. 223-226, 5 figs. Constructed by Roll, at Clus, Switzerland; results of tests made.

Fire Resistance. The Resistance to Fire of Concrete and Reinforced Concrete, F. C. Lea and R. F. Stradling. Engineering, vol. 114, nos. 2959 and 2960, Sept. 15 and 22, 1922, pp. 341-344 and 380-382, 19 figs. Results obtained from experimental work. Considers possibility of making concrete which shall retain its strength during and after exposure to high temperatures liable to occur in a building fire; possibility of preventing steel from reaching such temperature that its strength is reduced to or below, that required to carry loads in building. Paper read before Brit. Assn.

Tile, Disintegration in Peat. Durability of Concrete Tile in Peat, John T. Stewart. Am. Peat Soc. Jl., vol. 15, no. 3, July 1922, pp. 26-32. Discussion of subject from drainage engineer's standpoint. Description of tile lines at Grand Rapids and Coon Creek.

Sea-Water Action. Tests of Concrete in Sea Water, L. C. Wason. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 7, Sept. 1922, pp. 1597-1604, 4 figs. Based on over 13 years of study of specimens, writer makes tentative deductions on cause of failure of concrete from pier of Charleston Navy Yard, and suggestions for design so as to make future structures as nearly as possible proof against disintegration by sea water.

Sand Test. Colorimetric Test for Concrete Sand Studied, Charles E. Proudley. Eng. News-Rec., vol. 89, no. 15, Oct. 12, 1922, pp. 617-618. Limitations found in standard test for organic impurities in studies by Bur. of Pub. Roads.

CONCRETING

Hetch Hetchy Dam. Pouring 1600 Cu. Yards of Concrete per Day. Contract Rec., vol. 36, no. 41, Oct. 11, 1922, pp. 991-994, 1 fig. Average of 100 yd. per hr. has been maintained on Hetch Hetchy dam.

CONCRETE CONSTRUCTION

Slabs. Moments and Stresses in Slabs, H. M. Westergaard and W. A. Slater. Reprint and Circular Series of Nat. Research Council, no. 32, 124 pp., 65 figs. Information which correlates results of tests of fairly large number of slab structures; results of analysis to help formulation of building regulations for slabs. Reprinted from Proc. Am. Concrete Inst., 1921.

CONCRETE CONSTRUCTION, REINFORCED

Water-Retaining Structures. Reinforced Concrete for Water Retaining Structures, H. C. Ritchie. S. African Eng., vol. 33, no. 7, July 31, 1922, pp. 12-132, 4 figs. Notes on design and construction of dams, recervoirs, conduits, water towers, filter beds, etc. (Abstract.) Paper read before Instn. Water Engrs.

CONDUITS

Pressure. Reinforced-Concrete Pressure Conduits (Conduites forcées en ciment armé), J. Delamarche. Revue Universelle des Mines, vol. 14, no. 5, Sept. 1, 1922, pp. 383-403, 15 figs. Data on principal conduits in service; construction on single and double conduits of 6m. diameter; reinforcing metalwork.

CONDENSERS, STEAM

Performance. Report of an Investigation of Condenser Performance in the St. Louis Water Department, L. A. Day, Am. Water Works Assn. Jl., vol. 9, no. 5, Sept. 1922, pp. 696-702, 1 fig. Study of condensing apparatus with view of increasing vacuum on pumps.

CONVERTERS

Synchronous. Satisfactory Application of Synchronous Converters in Mining Service, J. L. McK. Yradley. Coal Industry, vol. 5, no. 9, Sept. 1922, pp. 383-386, 5 figs. Recent developments.

Rotary. 1,500-Volt 50-Cycle Rotary Converters. Engineer, vol. 134, no. 3480, Sept. 8, 1922, pp. 252-253, 2 figs. Details of converters built by Oerlikon Co., Switzerland.

CONVEYORS

Assembling by. Assembling by Conveyor Warren Ordway. Machy. (N. Y.), vol. 29, no. 2, Oct. 1922, pp. 103-106, 4 figs. Recently developed assembly system for increasing production and reducing manufacturing costs.

Belt. Belt-Conveyor System in Plant of By-Products Coke Corp. (S. Chicago), H. Hilman Smith, Jr., Belting, vol. 21, no. 3, Sept. 1922, pp. 17-22, 7 figs. Many large belts used in handling coal and coke, some in open, others housed. All purchased on guaranteed tonnage basis. Service records of belts.

Belt Conveyors in the Coal Mine, Anton M. Oliver. Coal Industry, vol. 5, Sept. 1922, pp. 405-407, 2 figs. Factors affecting carrying capacity; determination of belt pull and number of plies. Points out that belt specifications should be left to manufacturer.

Gravity. What it Pays to Know About Material Handling, W. T. Spivey. Factory, vol. 29, no. 4, Oct. 1922, pp. 395-397, 450, 452 and 454, 6 figs. Use of gravity roller conveyors.

Workshop, Railless. Railless Conveyances for Work-Shops, Richard Hänchen. Eng. Progress. vol. 3, no. 10, Oct. 1922, pp. 232-235, 11 figs. Advantages of transport without rails; hand-operated conveyances without rails; universal and lifting transport barrows; platform lorries; lefting transport lorries; portable and dirigible shop cranes; electric transport lorries.

COPPER

Elastic Limits under Stress. Elastic Limits of Copper Under Cyclical Stress Variations, H. Gough. Engineering, vol. 114, no. 2958, Sept. 8, 1922, pp. 291-293, 5 figs. Describes author's method and machine for determining fatigue range of stress from test on single specimen. Summary of report to Elasticity and Fatigue Panel of Aeronautical Research Committee.

COPPER METALLURGY

Smelting. Pyritic Smelting at the Siemens-Kwarzchana Copper Works, in the Caucasus, C. Offerhaus. Eng. and Min. Jl.-Press, vol. 114, no. 14, Sept. 30, 1922, pp. 589-596, 8 figs. Plant a modern one, consisting of sintering pots, blast furnaces, converters, and refining furnaces; metallurgical results good and costs low; blast furnace operation.

CORROSION

Iron and Steel. The Corrosion of Iron and Steel, Robert Hadfield. Roy. Soc. Proc., vol. 101, no. A713, Sept. 1, 1922, pp. 472-486, 2 figs. Refers to wastage of world's iron and steel due to corrosion, and describes number of recent experiments carried out by author with regard to copper steel. It is shown that small copper content, say 0.16 to 0.25 per cent, is beneficial, provided condition is that of bare metal exposed to atmospheric corrosion.

COST ACCOUNTING

Alignment Charts. The Graphical Solution of Cost and Production Problems, Ludwig Weindling. Indus. Management, vol. 64, no. 3, Sept. 1922, pp. 151-152, 2 figs. Gives examples of application of alignment charts to solution of cost and production problems.

Factory Expense Distribution. Engineering Methods Applied to Cost Finding, Robert S. Denham. Indus. Management, vol. 64, no. 3, Sept. 1922, pp. 155-159. Factory survey and expense distribution.

CRANES

Double. Double Cranes for Harbours. Eng. Progress, vol. 3, no. 10, Oct. 1922, pp. 213-215, 4 figs. Describes construction of double cranes put on market by German Machine Factory Corp. (Denag), which are particularly suitable for accelerating handling of goods.

Port-Terminal. The Port Terminal Crane, H. McL. Harding. Port and Terminal, vol. 2, no. 8, Sept. 1922, pp. 11-13, 7 figs. Discusses types of dock cranes and advantages of special port-terminal type.

CULVERTS

Concrete, Laying. Laying Concrete Culvert Pipe, Paul Kircher. Ry. Rev., vol. 71, no. 13, Sept. 23, 1922, pp. 407-410, 8 figs. Principles governing successful use of concrete pipe; some features of desirable field practice, including handling.

CUTTING TOOLS

Stress Determination in. An Account of Some Experiments on the Action of Cutting Tools, E. G. Coker and K. C. Chakko. Instn. Mech. Engrs. Proc., vol. 1, no. 3, 1922, pp. 567-592 and (discussions) 593-621, 28 figs. Describes experiments made by aid of polarized light to determine stresses and stress distribution in cutting tools.

CYLINDERS

Machining. Machining the Stutz D. H. Motor Cylinder and Head, Robert Mawson. Can. Machy., vol. 28 no, 14 ,Oct. 5, 1922, pp. 37-38, 9 figs. Jigs and fixtures in used holding parts; twelve cylinders milled at one setting; pieces easily and quickly located by means of sliding supports and spring dowels.

D

DAMS

Model Experiments. Experiments with Models of the Gilboa Dam and Spillway, R. W. Gausmann and C. M. Madden. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 7, Sept. 1922, pp. 1503-1528, 14 figs. Results of experiments made with models to determine carrying capacity of projected spillway channel and satisfactory section of stepped, overfall dam. Discusses application of principles of homology to models in question.

Tieton River, Wash. Construction of the Tieton Dam, W. A. Scott. Eng. World, vol. 21, no. 3, Sept. 1922, pp. 149-151, 5 figs. Details of construction of dam by U.S. Reclamation Service to create storage reservoir of capacity of 202,500 acre-ft. of water and provide for irrigation of additional 100,000 acres of land in Yakima and tributary valleys.

Multiple-Arch. Hydroelectric Plant of Barbellino (L'Impianto idroelettrico del Barbellino), Felice Zanon. Industria, vol. 36, no. 16, Aug. 31, 1922, pp. 302-305, 7 figs. Describes multiple-arch dam 48 m. high, its design and calculation.

Muscle Shoals. Muscle Shoals — The Wilson Dam, Littell McClung. Concrete, vol. 21, no. 3, Sept. 1922, pp. 71-74, 5 figs. To be largest concrete structure of its kind and greatest hydroelectric development in world. Total length 4,500 ft., width on bedrock 101 ft., total ultimate installation will generate 624,000 hp.

DIELECTRICS

Liquid. Arc Action on Some Liquid Insulating Compounds, C. J. Rodman. Am. Electrochem. Soc. advance paper, no. 7, for meeting Sept. 21-23, 1922, pp. 45-50, 4 figs. Liquids possessing high dielectric strength, which havellow viscosity, comparatively high fire and flash points, were subjected to action of electric arc at and below liquid surface. Data obtained have practical application in operation of transformers, circuit breakers, condensers, and similar apparatus.

DIESEL ENGINES

Double-Acting Two-Cycle. New Double-Acting Two-Cycle Diesel Engine. Mar. Engr. & Naval Architect, vol. 45, no. 540, Sept. 1922, pp. 361-365, 5 figs. Describes experimental engine built by North British Diesel Engine Works, whose successful results have encouraged builders to proceed with construction of large unit of 2250 i.hp.; test results.

Hydroelectric Plants, Application to. The Diesel Engine, Its Economic Value Compared With That of Other Prime Movers (Les moteurs Diesel. Leur valeur économique comparée à celle d'autres machines motrices), Alfred Buchi. Bul. Technique de la Suisse Romande, vol. 48, nos. 15, 16, 17 and 20, July 20, Aug. 5, 19 and Sept. 30, 1922, pp. 169-173, 186-189, 193-197 and 229-235, 16 figs. July 20: Application of Diesel engines in hydroelectric plants; cost comparison Aug. 5: Comparison of Diesel engines and hydraulic power for production of alternating current. Aug. 9: Diesel engine is more economical where spare units can be used; hydraulic power is preferable for constant loads. Sept. 30: Most advantageous proportion in distribution of energy to be furnished by a system which has a Diesel-engined central station; calculation of cost of production per kw-hr.

Waste-Heat Utilization. Utilization of Exhaust-Gases, S. Snuyff. Motorship, vol. 7, no. 10, Oct. 1922, pp. 770-771, 1 fig. Investigates possibilities of effective use of Diesel-engine waste heat.

DURALUMIN

Economical Use. The Economical Use of Duralumin as a Substitute for Steel in Compression. Air Service Information Circular, vol. 4, no. 337, Apr. 1, 1922, 11 pp., 6 figs. Report, embodying study of weight ratios for common loads, lengths, and fixities, to enable designer to choose readily between duralumin and steel for lightest weight.

E

EDUCATION, ENGINEERING

Future of. The Future of Engineering Education, Chas. F. Scott. Eng. Education, vol. 13, no. 1, Sept. 1922, pp. 2-9. Points out that it should include preparatory and high school and also first few years after graduation. Lack of intelligent understanding among teachers of preparatory schools and among parents as to what engineering really is. Presidential address.

Mining and Metallurgy. Mining and Metallurgy at Yale University, George J. Young. Eng. & Min. Jl.-Press, vol. 114, no. 16, Oct. 14, 1922, pp. 682-684, 4 figs. Curricula provide for selection of fundamental subjects. Method of presentation given particular attention. Specialization subordinated to broad study.

Post-War. Engineering Education After the War, Arthur M. Greene, Jr. U. S. Bur. of Education, Bul., vol. 50, 1922, 27 pp. Deals with Students' Army Training Corps; proposed schedule of studies for four engineering courses as proposed by Committee on Educational and Special Training; schedule of studies submitted by Rensselaer Polytechnic Inst.; later developments; business administration; junior college; data from replies and catalogues.

ELECTRIC FURNACES

Closed-Crucible. New Type of French Electric Furnace, R. Sylvany. Iron Age, vol. 110, no. 12, Sept. 21, 1922, pp. 763-764. Describes furnace, based on idea of T. Levoz, used during war for production of high-speed steel. Closed crucible with only one opening for charging material and additions for pouring finished metal. Girod, Keller and Hewitt types compared. (Abstract.) Paper before Am. Foundrymen's Assn.

Design. Electric Heat, Its Generation, Propagation and Application to Industrial Processes, E. F. Collins. Am. Electrochem. Soc. advance paper, no. 22, for meeting Sept. 21-23, 1922, pp. 233-260, 13 figs. Discusses more important laws of furnace design. Overall cost of electric heating.

Heroult. The Heroult Furnace and Its Smelting Operation (Der Heroult-Ofen und sein Schmelzbetrieb), K. Kerpely. Giesserei-Zeitung, vol. 19, nos. 34 and 35, Aug. 29 and Sept. 5, 1922, pp. 487-491 and 509-513, 10 figs. Deals with electrical conditions; lining; electric equipment; electrodes; starting fire in furnace; removal of clinker; deoxidation and desulphurization; hot charge.

High-Temperature. Principles of High Temperature Furnace Design, E. L. Smalley. Am. Electro-chem. Soc., advance paper, no. 10, for meeting Sept. 21-23, 1922, pp. 77-88. Discusses attributes which electric furnaces should have, judged from viewpoints of highest quality of products, lowest cost of operation and maintenance, and greatest safety in operation at high temperatures.

Iron Founding. Melt and Anneal Electrically, Herbert R. Simonds. Foundry, vol. 50, no. 15, Aug. 1, 1922, pp. 609-612 and 621, 8 figs. Steel and malleable iron are melted in arc furnace and resistance type is employed for annealing castings.

Refractories for. Refractory Materials for Electric Furnaces, Alfred B. Searle. Beama, vol. 11, no. 4, Oct. 1922, pp. 664-670. Shows what has been done as regards refractory materials for electric furnaces and in what directions further research may usefully be conducted. It is found that newer and, as yet, not fully-developed refractory materials, such as carborundum, fused alumina, zirconium and zircon, may in time replace some of those at present largely used.

ELECTRIC LOCOMOTIVES

High-Speed Passenger. North-Eastern Railway Electrification. Elec. Rev., vol. 91, no. 2340, Sept. 29, 1922, pp. 436-437, 2 figs. Details of first high-speed passenger locomotives for service on British trunk-line railway.

ELECTRIC MOTORS

Control Equipment. Points That Should Be Considered When Installing Motor Control, Herbert Harries. Indus. Engr., vol. 80, no. 9, Sept. 1922, pp. 433-434, 1 fig. Equipment for providing low-voltage release and low-voltage protection for a.c. and d.c. drives.

Railway. The Manufacture of Railway Motors, J. K. Stotz. Elec. Jl., vol. 19, no. 10, Oct. 1922, pp. 429-435, 15 figs. Deals with frame, housings, poles, bearings, brushholders, field coils, armature shafts, commutators, armature coils and winding, motor assembly, etc.

ELECTRIC MOTORS, A.C.

Synchronous. Standardization in the Design and Application of Synchronous Motors Driving Refrigerating Machinery, R. A. McCarty. Refrig. Eng., vol. 9, no. 1, July 1922, pp. 4-6 and 14-15, 8 figs. Deals with type of motor rotor, use of flywheels, amount of flywheel effect for given installation, method of determining displacement of rotor, due to varying torque.

Induction. The Effect of Frequency Changes on the Characteristics of Polyphase Induction Motors, J. K. Kostko. Elecn., vol. 89, no. 2313, Sept. 15, 1922, pp. 286-287, 5 figs. It is shown that for any one of power elements the ratio of values at two different frequencies depends only on ratio of these frequencies and on simple function of constants of motor, so that, with aid of given curves, it is possible to find these ratios without calculation.

ELECTRIC PLANTS

Croydon, England. The Croydon Electricity Undertaking. Elec. Rev., vol. 91, no. 2338, Sept. 15, 1922, pp. 377-381, 10 figs. Notes on installation of two 5000-kw. and one 3000-kw. three-phase-sets, generating at 6300 volts; division of single-phase a.c. network into two; installation of three sets of 1500-kw. Scott-connected transformers; etc.

ELECTRIC POWER

Cost Checking. By Measurement of Current Used and Extended Records Large Savings Can be Made in Power Cost. Coal Age, vol. 22, no. 13, Sept. 28, 1922, pp. 494-496. Points out that importance of cost records grows as power use increases. Need for more recording devices. Report of committee on methods of checking power costs before W. Va.-Ky. Assn. of Mine, Mech. & Elec Engrs.

ELECTRIC SWITCHES

AIR-BREAK. Air Break Switches Reduce Maintenance, H. E. Hoadley. Elec. World, vol. 80, no. 14, Sept. 30, 1922, pp. 703-704, 3 figs. Richland Public Service Co. avoids duplicate oil switches and uses air-break type. Provisions in outdoor substation for future additions.

ELECTRIC TRANSMISSION LINES

DESIGN. Aspects of the Most Economical Transmission Line Design, William T. Taylor Elec. Rev., vol. 91, no. 2336, Sept. 1, 1922, pp. 292-294. Notes on cost of transmission line; electrical efficiency; location of line.

HIGH-TENSION. The International Status of Superpower Systems. Elec. World, vol. 80, no. 16, Oct. 14, 1922, p. 814. Use of high-voltage cables and trend of practice and regulation are discussed at international conference on high-tension transmission held in Paris.

EXTRA-HIGH-PRESSURE. Extra High Pressure Transmission Lines, R. Borlase Matthews. Beama, vol. 11, no. 2, Aug. 1922, pp. 559-562, 5 figs. Consideration of technical features of design and construction.

120,000-VOLT. The 120,000-Volt Transmission Line at Basse-Isere (La ligne de transmission d'énergie à 120.000 volts de la Basse-Isere), E. Duval and S. Boukspoun. Revue Générale de l'Electricité, vol. 12, no. 11, Sept. 16, 1922, pp. 387-397, 18 figs. Construction work; transmission lines; poles; insulators; etc.

ELECTRICITY

MATTER, AND. Electricity and Matter, Ernest Rutherford. Instn. Elec. Engrs., Jl., vol. 60, no. 310, June 1922, pp. 613-618, 1 fig. Review of advances made in recent years in knowledge of relations between electricity and matter. Notes on constitution of atoms of elements.

ELECTRIC RAILWAYS, TRACK

URBAN. Urban Electric Railway Tracks, E. J. McIlrath. Eng. & Contracting, vol. 58, no. 12, Sept. 20, 1922, pp. 279-281. Principles of construction. Paper presented at City Paving Conference, Philadelphia.

ELECTRIC WELDING

SPOT, MACHINE FOR. Things That Can Be Done in High-Speed Welding of Small Parts, E. H. Hubert. Indus. Engr., vol. 80, no. 9, Sept. 1922, pp. 413-415, 5 figs. Describes semi-automatic electric spot welding machine used, with procedure whereby 1000 welds an hour are made in plant of E. N. Garrison Mfg. Co., Bridgeport, Conn.

CABLES, REPLACING. Replacing Cables on a Two to One Traction Elevator Machine, F. A. Annett. Power, vol. 56, no. 10, Sept. 5, 1922, pp. 372-375, 11 figs. Describes method which has been used successfully for number of years in cabling two-to-one traction elevators, eliminating much of hard work generally attendant with such jobs.

EMPLOYMENT MANAGEMENT

PERSONNEL PLANNING. Organization Personnel Planning, B. A. Franklin. Indus. Management, vol. 64, no. 3, Sept. 1922, pp. 181-183. Problem of planning and scheduling personnel work.

SMALL FACTORY. A Small Employment Department for a Small Factory. Factory, vol. 29, no. 4, Oct. 1922, pp. 392-394, 2 figs. Describes plan used by 150-man plant.

ENGINEERS

LICENSING. Engineers in Many Fields Discuss Licensing. Eng. News-Rec., vol. 89, nos. 12 and 15, Sept. 21 and Oct. 12, 1922, pp. 470-472 and 616-617. Extracts from letters commenting on editorial discussion of subject published in same journal, July 6.

ENGINEHOUSES

RECTANGULAR CONCRETE. New Engine House Construction on the Southern Pacific. Ry. Rev., vol. 71, no. 13, Sept. 23, 1922, pp. 405-407, 4 figs. Two rectangular concrete enginehouses, one at Mojave, Cal., and other at Indio, Cal., presenting departure from conventional design.

EVAPORATORS

HIGH- AND LOW-PRESSURE. Evaporators in the Stationary Power Plant. Power vol. 56, no. 12, Sept. 19, 1922, pp. 449-454, 10 figs. Deals withhigh-pressure and low-pressure systems, describing apparatus and showing how layout is determined by heat balance of particular plant.

F

FANS

DESIGN. Fan Blower Design, H. F. Hagen. Am. Soc. Heating & Vent. Engrs., Jl., vol. 28, no. 5, July 1922, pp. 491-504, 9 figs. Describes methods by which forms and proportions of silentvane fan designed by author were determined. Design of fans based on theories of hydrodynamics.

FEEDWATER HEATERS

TESTING. Teet of a Cochrane Open Feed Water Heater, P. J. Searles. Am. Soc. Nav. Engrs. Jl., vol. 34, no. 3, Aug. 1922, pp. 430-437, 2 figs. Describes simple method of test which can be used in any power plant, is easily adaptable to any type of heater, and sufficiently accurate for all practical purposes.

FIRE PREVENTION

EQUIPMENT. Fire Protection for Industrial Plants, Charles L. Hubbard. Southern Engr., vol. 37, no. 6, Aug. 1922, pp. 46-51, 17 figs. Details regarding kind of apparatus to use for protection as applied to any building of similar type.

RECOMMENDATIONS. Fire Prevention and Fire Protection in Relation to the Public Water Supply, Frank C. Jordan. Am. Water Works Assn. Jl., vol. 9, no. 5, Sept. 1922, pp. 731-740 and (discustion) 740-742. Comparison of conditions in America and Europe. Author recommands elimination of shingle roofs, clean-up programs, and makes other suggestions for prevention of fires.

FLOW OF WATER

KUTTER'S FORMULA. Flow in Tennessee Checked Against Hydraulic Formulas, Benjamin E. Hones. Eng. News-Rec., vol. 89, no. 15, Oct. 12, 1922, pp. 610-612, 4 figs. Study of these and Irrawaddy River curves indicates that Ganguillet and Kutter's [illegible] C [illegible] slope and hydraulic radius.

FLOODWAYS, THROUGH. Studies of Flow Through Cleared and Uncleared Floodways, Charles E. Ramser. Eng. News-Rec., vol. 89, no. 15, Oct. 12, 1922, pp. 598-599, 2 figs. Velocities taken by current meter from boat. Difference in discharge capacity 62½ per cent.

FLUE-GAS ANALYSIS

TESTING APPARATUS. Heating-Gas Tester to Dtermine CO_2 Content and Gas Loss Duplex-Mono (Heizgasprüfer auf CO_2-Gehalt und Gasverlust), K. Münzer. Wärme, vol. 45, no. 31, Aug. 11, 1922, pp. 377-379, 9 figs. Describes Duplex-Mono testing apparatus for constant control of flue-gas composition. Test results with original diagrams drawn from practice.

FORGE SHOPS

HEPPENSTALL CO., PITTSBURGH. Works of the Heppenstall Forge and Knife. Forging & Heat Treating, vol. 8, no. 9, Sept. 1922, pp. 388-398, 15 figs.; 399-409, 8 figs.; 410-411, 2 figs.; and 412-413, 2 figs. First article describes modern forge plant designed and equipped to specialize in large and medium-sized forgings. Plan of plant layout shows position of equipment in each department, relation of departments and means of routing during manufacture. Second article, by R. F. Keifer, describes steam-generating plant. Third article describes new oil-fired forge heating furnaces. Fourth article describes offices, laboratories and cafeteria. See also Iron Trade Rev., vol. 71, no. 13, Sept. 28, 1922, pp. 845-851, 9 figs.

FOUNDATIONS

CONCRETE. Concrete Basements and Foundations. Contract Rec., vol. 36, no. 2, Sept. 13, 1922, pp. 909-912, 4 figs. Instruction issued by Portland Cement Assn. concerning use of monolithic concrete or concrete blocks for foundation walls; ensuring watertightness.

FOUNDRIES

BRITISH. A Modern British Foundry. Eng. Production, vol. 5, no. 103, Sept. 21, 1922, pp. 271-275, 13 figs. Notes on plant and methods of Sterling Metals, Ltd., Coventry, England.

FUELS

ECONOMY. Report on Fuel Economy. Colliery Guardian, vol. 124, no. 3220, Sept. 15, 1922, pp. 641-642. Fifth report of committee appointed by Brit. Assn. for investigation of fuel economy, utilization of coal, and smoke prevention. Deals with oil-fuel supplies; chemistry of coal; brown coal and lignites; domestic heating and cooking appliances; steam raising and power production; smoke abatement. See also Iron & Coal Trades Rev., vol. 105, no. 2846, Sept. 15, 1922, pp. 380-381.

PACIFIC COAST PROBLEMS. The Fuel Problems of the Pacific Coast. Mech. Eng., vol. 44, no. 10, Oct. 1922, pp. 655-659. Abridgments of following papers: The Future Fuel Supply of California, C. H. Delany; The Railway Fuel Problem of the Pacific Coast, J. C. Martin; The Marine Fuel Problem for the Pacific Coast, D. Dorward, Jr.; Conservation of the Fuel Supplies of the Pacific Coast, F. H. Sibley.

See also Coal; Oil Fuel; Pulverized Coal.

FURNACES

DOORS. Furnace Doors, H. J. Trupin, Machy. (Lond.), vol. 21, no. 253, Oct. 5, 1922, pp. 20-21, 9 figs. Their design and suitability.

FURNACES, BOILER

FORCED-DRAFT. Cast-Iron Sectional Boilers with Forced-Draft Grates (Gusseiserne Gliederkessel mit Unterwindfeuerung), Mór Réti. Gesundheits-Ingenieur, vol. 45, no. 29, July 22, 1922, pp. 373-376, 4 figs. Writer gives account of successful experiences during two years with use of forced-draft grates attached to different types of sectional boilers, for use of low-grade fuel.

MECHANICAL DRAFT. Mechanical Draft, A. W. Binns. Power Plant Eng., vol. 26, no. 19, Oct. 1, 1922, pp. 939-942, 10 figs. Its control, relation to heat transfer, gas velocity and difficulties experienced in specific installation.

MOIST-FUEL GRATES. Grates for Moist Fuel Zuce Kogan. Power Plant Eng., vol. 26, no. 20, Oct. 15, 1922, pp. 989-993, 10 figs. Practical and theoretical considerations involved in design and operation.

FURNACES, ENAMELING

GAS-FIRED. A New Type of Gas-Fired Vitreous Enameling Furnace, H. H. Clark. Am. Ceramic Soc. Jl., vol. 5, no. 8, Aug. 1922, pp. 478-487, 8 figs. Intermittent-type furnace having working chamber 4 ft. wide, 3 ft. high and 10 ft. long, heated by 10 burners; can be brought to working temperature in less than an hour and will turn out from 12 to 24 loads of work an hour.

The Intermittent Gas-Fired Enameling Furnace, Frederic C. Mackey. Am. Gas Jl., vol. 117, no. 12, Sept. 16, 1922, pp. 245-249 and 256, 7 figs. Compares electricity, gas, coal and oil in vitreous enameling industries, showing advantages of direct-fired gas furnace, figures compiled from production results obtained by using intermittent-type furnace.

FURNACES, HEATING

REGENERATIVE PIT. Pit Reheating and Soaking Pit Furnaces, W.-E. Groume-Grjimailo. Iron Age, vol. 110, no. 16, Oct. 19, 1922, pp. 1013-1014, 4 figs. Removal of waste gas a primary consideration rarely achieved; principles governing rational design. From "The Flow of Gases in Furnaces," Wiley & Co., publishers.

G

GALVANIZING

HOT. Hot Galvanizing, Claude O. Kell. Am. Mach., vol. 57, no. 16, Oct. 19, 1922, pp. 605-607, 3 figs. Methods employed; design and construction of plant with suggested layout; selection and care of equipment.

MODERN. What is the Matter with Modern Galvanizing?, J. A. Singmaster and G. F. Halfacre. Min. & Metallurgy, no. 190, Oct. 1922, pp. 15-16. Results of investigation show waste of materials caused by insufficient coating.

GASES

SPECIFIC GRAVITY. Get Specific Gravity by Effusion, Dyke Wilson. Gas Age-Rec., vol. 50, no. 11, Sept. 9, 1922, pp. 331-322, 1 fig. Describes improved form of effusion apparatus for determination of gas densities and discusses methods of calculation.

GAS ENGINES

Blast-Furnace. British Blast-Furnace Gas Engines. Power, vol. 56, no. 16, Oct. 17 1922, pp. 608-609, 2 figs. Notes on design of large gas engines; large British engines; double-acting engines; ignition systems; future of gas engine in Great Britain.

British Blast-Furnace Gas Engines, F. Johnstone-Taylor. Iron & Coal Trades Rev., vol. 105, no. 2847, Sept. 22, 1922, pp. 422-424, 9 figs. Relation of design to reliability and efficiency. Main field of large gas engines is said to be a connection with driving blowing engines for blast furnaces, and in utilising waste gases therefrom for power production.

GAS PRODUCERS

Preheated-Air. Burning Fuel in Gas Producers With Preheated Air (L'utilisation des combustibles dans les gazogènes à fusion des cendres soufflés au vent chaud), Auguste Dessemond. Revue Universelle des Mines, vol. 14, no. 3, Aug. 1, 1922, pp. 201-214, 6 figs. partly on supp. plate. Describes plant successfully run by Saint Etienne coal mining company for burning coal waste containing over 50 per cent ash.

GAS TURBINES

Hepburn-Forbes. Gas Turbine Controversy. Practical Engr., vol. 66, no. 1857, Sept. 26, 1922, p. 205. In writer's belief, Holzwarth turbine is overrated. Discusses proposed new Hepburn-Forbes system in which sub-atmospheric, single-fluid constant-pressure cycle has been adopted.

GASOLINE

Natural Gas as Source. Design and Operation of a Low-Pressure Absorption Plant W. P. Dykema and A. A. Chenoweth. U. S. Bur. of Mines Tech. Paper, no. 263, 1922, 42 pp., 16 figs. Deals with construction, operating methods, many changes necessitated, and difficulties encountered in recovery of gasoline from rich casing-head natural gas by absorption at low pressure. Describes large plant in Cushing oil field in Oklahoma. Bibliography on natural gas.

GEAR CUTTING

Bevel Gears. Considerations affecting the Design and Operation of Bevel-gear Machines, I. H. Wright. Machy. (Lond.), vol. 21, no. 523, Oct. 5, 1922, pp. 13-15, 7 figs. Templet-formed gear teeth.

Cutting Bevel Gears. Machy. (Lond.), vol. 20, nos. 516 and 520, Aug. 17 and Sept. 14, 1922, pp. 612-615 and 735-738, 12 figs. Aug. 17: Principles governing operations of generating planers and general methods of setting up and adjusting Bilgram machine for cutting bevel gears. Sept. 14; Setting up Gleason bevel gear generators; time required for cutting gears of different sizes and pitches.

Cutting Large Bevel Gears, Franklin D. Jones. Machy. (N. Y.), vol. 29, no. 2, Oct. 1922, pp. 116-122, 15 figs. Methods of stocking out and finishing bevel gears on single and two-tool planers of form-copying or templet types.

GEARS

Bevel. Spiral Bevel Gears, J. H. Wright. British Machine Tool Eng., vol. 2, nos. 14, 15 and 16, Mar.-Apr., May-June and July-Aug. 1922, pp. 460-464, 490-495 and 525-528, 23 figs. Evolutionary forms of Citroen double helical, spiraloid, and spiral-type bevel gears, and their various objections and disadvantages as against true Archimedean spiral bevel. May-June: Explains mechanism of machine for cutting spiral bevel gears of Archimedean spiral type. July-Aug.: Mode o foperation of Smith & Coventry spiral bevel gear planer.

Grinding. Gear Tooth Grinding. Machy. (Lond.), vol. 21, no. 523, Oct. 5, 1922, pp. 10-12, 7 figs. Loading of gear teeth; tooth pressure; importance of accuracy; types of machines.

Hot-Rolled. Producing Spur and Bevel Gears with Hot-Rolled Teeth. Automotive Industries, vol. 47, no. 13, Sept. 28, 1922, pp. 618-621, 5 figs. Describes machines used and methods followed in manufacture of hot-rolled gears by Anderson Rolled Gear Co., Cleveland, Ohio. Herringbone type of bevel gear among varieties made by this process. See also Eng. Production, vol. 5, no. 102, Sept. 14, 1922, pp. 253-257, 11 figs.; and Iron Age, vol. 110, no. 14, Oct. 5, 1922, pp. 861-863, 6 figs.

Teeth, Strength of. Strength of Internal Spur Gear Teeth, Douglas T. Hamilton. Machy. (N.Y.), vol. 29, no. 2, Oct. 1922, pp. 109-111, 5 figs. Brief review of improved method for determining strength. Factors governing strength; determining initial point of tooth contact; application of Lewis formula.

Tooth-Measuring Machine. Machine for Measuring Gear Teeth. Engineering, vol. 114, no. 2961, Sept. 29, 1922, p. 410, 9 figs. partly on p. 411. Describes machine for measuring errors.

GOLD MINING

Thawing Frozen Gravel. Recent Progress in the Thawing of Frozen Gravel in Placer Mining, Charles Janin. U. S. Bur. of Mines, Tech. Paper, no. 309, 1922, 34 pp., 11 figs. Describes methods evolved in working of frozen gravels in Alaska and Yukon Territory.

GRAIN ELEVATORS

Concrete, Reconstruction. Concrete Grain Elevator Rebuilt at Chicago. Eng. News-Rec., vol. 89, no. 12, Sept. 21, 1922, pp. 483-485, 3 figs. Extensive repairs to foundations and bins of 10,000,000-bu. Northwestern elevator wrecked by explosion. New dust-removal apparatus.

GRINDING

Camshafts. Accurate Camshafts Produced by Grinding, R. Harrison. Can. Machy., vol. 28, no. 11, Sept. 14, 1922, pp. 20-22, 5 figs. Treatise on British methods; location of master cams; points to consider in obtaining accurate work.

Foundry and Steel-Mill. Grinding in Foundry and Steel Mill. Machy. (N.Y.), vol. 29, no. 2, 1922, pp. 126-130, 9 figs. Types of grinding machines used in foundries; wheel selection for snagging; arrangement of cleaning room; wheel efficiency and grinding costs; records of wheel costs; billet grinding.

Small Tools. Grinding in the Small Tool Industry. Machy. (Lond.), vol. 20, no. 519, Sept. 7, 1922, pp. 696-702, 19 figs. Grinding straight edges; sharpening cutters; grinding plug gages, micrometer parts, etc.

H

HANDLING MATERIALS

Chemical Plants. Safe Handling of Materials in Chemical Plants. W. G. Whitman. Chem. Age, (N.Y.), vol. 30, no. 9, Sept. 1922, pp. 377-379. Non-chemical hazards; handling of gases and liquids; overflowing tanks; explosions. Paper read before nat. safety Council.

Factories. Handling the Finished Products of Industry, Graham L. Montmogery. Chem. & Met. Eng., vol. 27, no. 16, Oct. 18, 1922, pp. 779-783, 3 figs. Layout of Baltimore refinery of American Sugar Refining Co. Deals with packing bulk sugar in barrels, handling empty and filled barrels, loading bulk sugar in bags, delivering sugar to automatic package equipment, automatic filling of paper cartons, etc.

Tiering Machines. Tiering Machines. Engineering vol. 114, no. 2959, Sept. 15, 1922, pp. 321-325, 8 figs. Describes models of portable elevators developed by Economy Engineering Co. of Chicago. Examples of use of tiering machines.

Unloading Plants. Unloading Appliances, K. Fölsche. Eng. Progress, vol. 3, no. 10, Oct. 1922, pp. 228-230, 4 figs. Describes design and mode of, action of mechanical appliances designed for unloading railway trucks by means of jet of liquid arranged to be directed as required and, evidently, possessing sufficient force to fulfill desired aim.

HARBOR IMPROVEMENT

Toronto, Canada. Toronto Waterfront Improvements, E. L. Cousins. World Ports, vol. 10, no. 11, Sept. 1922, pp. 56-71, 10 figs. Describes improvements made by the Toronto Harbor Commission.

HARDNESS

Testing. An Accurate Method of Determining the Hardness of Metals, with Particular Reference to Those of a high Degree of Hardness, R. L. Smith and G. E. Sandland. Instn. Mech. Engrs. Proc., vol. 1, no. 3, 1922, pp. 623-641, 12 figs. By knowing impression given by standard load, it is claimed to be possible, by means of a formula, to obtain ball-hardness figures, which are proportional to load required to give standard impression; this ball test fails at about 525 Brinell or 550 modified ball hardness. Includes five appendices.

HELIUM

Production. Present State of Production of Helium (L'état actuel de la fabrication de l'hélion), N. Kirilov. Vie Technique et Industrielle, vol. 3, no. 36, Sept. 1922, pp. 370-371, 1 fig. Describes plant and manufacturing processes at Calgary for production of 97 per cent helium.

HIGH VOLTAGES

600,000-Volts. 600,000-Volts of Electricity, C. Francis Harding. Sibley Jl., vol. 36, no. 7, Oct. 1922, pp. 136-140, 5 figs. Discusses what will happen at 600,000 volts. Account and results of series of tests carried out Purdue University to determine corona losses. Equipment has been installed at University to supply 600-kv. at 60-cycles with sufficient capacity to represent practical operating conditions.

HUMIDITY

Equilibria of Common Substances. Humidity Equilibria of Various Common Substances, Robert E. Wilson and Tyler Fuwa. Jl. Indus. & Eng. Chem., vol. 14, no. 10, Oct. 1922, pp. 913-918, 13 figs. Discusses various types of humidity equilibrium curves, and gives curves for various substances arranged in groups of related materials, as follows: natural and artificial textile fibers, pulp and paper fibers, foodstuffs, absorbents, various forms of carbon and inorganic solids.

HYDRAULIC TURBINES

Axial Thrust. Axial Thrust in Turbines (Poussée axiale et Couple moteur dans une turbine), A. Gay. Annales de l'Energie, vol. 2, no. 4, July-Aug. 1922, pp. 133-135, 3 figs. Equations on axial thrust of Francis turbines.

Draft Tubes. Notes on the Draught Tube of a Water Turbine, Otogorô Mivagi. Soc. Mech. Engrs.' Tokyo, Japan — Jl., vol. 25, no. 74, June 1922, pp. 39-50, 4 figs. Investigation of losses of energy; consideration of minimum loss and determination of minimum loss and determination of best form of draft tube.

Pelton Wheels. Experiments on a Pelton Wheel and Needle-Nozzle, A. H. Gibson. Instn. Mech. Engrs. Proc., vol. 1, no. 3, 1922, pp. 643-661, 8 figs. Tests indicate that efficiency of well-designed wheel and nozzle, even of small power, may be surprisingly high.

Problems. The Hydraulic Turbine in Evolution, H. Birchard Taylor and Lewis F. Moody. Mech. Eng., vol. 44, no. 10, Oct. 1922, pp. 633-640, 10 figs. New problems created by turbine evolution. Analysis of flow in high-speed turbine. Correlation of marine propeller with hydraulic turbine. (Abridgment.)

HYDROELECTRIC DEVELOPMENTS

Chile. Hydro-Electric Development in Chile. Engineering, vol. 114, no. 2958, Sept. 8, 1922, pp. 197-198, 6 figs., partly on p. 300. Details of plant under construction in Colorado River valley, which is part of scheme to be developed later.

India. Hydro-Electric Power in India, Arthur T. Arnall. Beama, vol. 11, nos. 1 and 2, July and Aug. 1922, pp. 465-473 and 546-553, 2 figs. July: Survey of water-power resources, including details of rainfall and run-off; problems of storage, irrigation and hydraulic works. Aug.; Characteristic schemes; water power and coal; future development.

Manitoba, Canada. Great Falls Development of Manitoba Power Co., F. H. Martin. Can. Engr., vol. 43, no. 11, Sept. 12, 1922, pp. 337-341, 5 figs. Ultimate development on Winnipeg River of 168,000 hp. planned; power house being built for initial installation of three 28,000-hp. units; operating head 56 ft.; maximun height dam 70 ft.; concrete centercone draft tubes.

HYDROELECTRIC PLANTS

California. Caribou 165,000-Volt Development, J. A. Koontz. Elec. World, vol. 80, no. 13, Sept. 23, 1922, pp. 648-652, 12 figs. Notes on 15,000-hp. impulse wheels, high-voltage lines over exceptionally rugged country and method of handling work and distributing material.

First Pit River Power Project Is Completed. Eng. News-Rec., vol. 89, no. 14, Oct. 5, 1922, pp. 570-571, 3 figs. Highest unit in continuous river development totals 90,000 hp. 202,000-volt power line 202 miles long.

QUEENSTON CHIPPAWA. Queenston-Chippawa Power Development, T. H. Hogg. Engrs. & Eng., vol. 39, no. 9, Sept. 1922, pp. 310-324, 16 figs. Engineering features of development with permanent works designed for installation of 550,000 hp. How maximum efficiency was secured in use of water under 305-ft. head. Details of waterway 13 mi. long with unique type of intake to prevent ice troubles, concrete-lined canal section 8 mi. long, hydraulic turbines of 55,000 hp. cap., etc.

The Queenston-Chippawa Hydro-Electric Development. Elec. Jl., vol. 19, no. 8, Aug. 1922, pp. 312-328, 27 figs. Contains general description, by F. A. Gaby; description of 55,000-hp. turbines, F. H. Rogers; the 45,000-kva. waterwheel generators, H. U. Hart; switching equipment, L. B. Chubbuck.

I

IGNITION

ELECTRIC. The Principles of Electrical Ignition, W. M. Thornton. Beama, vol. 11, no. 2, Aug. 1922, pp. 521-529, 3 figs. Notes on electric ignition by jump sparks; oscillating coil sparks; break spark ignition; condenser discharge sparks.

ILLUMINATION

ENGINEERING. Illumination Engineering, H. Buckley. Beama, vol. 11, no. 3, Sept. 1922, pp. 600-608, 8 figs. Experimental considerations. Notes on photometric, threshold, glare, spectral and flicker sensitivity.

IMPACT TESTING

LOADS ON TRACK BOLTS. Some Interesting Tests of Impact Loads on Track Bolts. Ry. Maintenance Engr., vol. 18, no. 8, Aug. 1922, pp. 279-281, 5 figs. Describes unique method developed to determine stresses induced by train, engine and pull of wrench.

INDUSTRIAL MANAGEMENT

CHARTS. Measuring Growth and Shrinkage by Means of Ratio Charts, Bert E. Holmes. Indus. Management, vol. 64, no. 3, Sept. 1922, pp. 165-168, 3 figs. Said to be simplest means of graphically illustrating rate of increase or decrease in any continuing factor of industrial activities, such as sales, production, inventories, etc. Presents table for quickly placing "rate of change" lines on ratio charts.

Charting as an Aid in Stabilizing Profits, Percy A. Bivine. Indus. Management, vol. 64, nos. 3 and 4, Sept. and Oct. 1922, pp. 175-179 and 213-215. Sept.: Development of graphic service. Oct.: Control, establishment and cost of charting organization.

COST ANALYSIS. Establishing a Rational Basis For Industrial Analyses, Harrington Emerson. Chem. & Met. Eng., vol. 27, no. 13, Sept. 27, 1922, pp. 644-646. Analysis of costs involved in equipment, personnel and materials. Method illustrated from statistics of U. S. railroads.

INSPECTION. Problems and Importance of Factory Inspection, John P. Meade. Monthly Labor Rev., vol. 15, no. 1, July 1922, pp. 13-23. Specific problems connected with inspection work. Paper read before Convention of Governmental Labor Officials of United Stated and Canada.

PRODUCTION CONTROL. Production Control in a Tire Manufacturing Plant, W. B. Mendenhall. India-Rubber World, vol. 66, no. 5, Aug. 1, 1922, pp. 729-732, 4 figs. Notes on what has been done in standardizing and controlling product in one plant. Outline of system employed.

PRODUCTION PLANNING. Effective Production Planning for the Drop Forge Shop, C. Oliver Wellington. Forging & Heat Treating, vol. 8, no. 9, Sept. 1922, pp. 418-420. Describes simple and economical system of profuction planning that controls operation not only of hammer units, but of preparatory and finishing processes during manufacture.

QUALITY CONTROL OF PRODUCTS. Control of Quality of Manufactured Goods as Affected by Size of Plant, G. S. Radford. Management Eng., vol. 3, no. 4, Oct. 1922, pp. 193-198, 4 figs. Outlines methods according to which large factories can more nearly approximate advantages of smaller ones while still retaining favourable opportunities peculiar to strong establishments.

RAW-MATERIAL CONTROL. Control of Raw Material to Suit Output, Gilbert L. Lacher. Iron Age, vol. 110, no. 12, Sept. 21, 1922, pp. 713-716 and 761-762, 9 figs. Management problems solved at Woodstock Typewriter Co. Close co-ordination of purchases and production. Shows forms or cards used in controlling raw and finished materials and movement through processes of manufacture.

INDUSTRIAL RELATIONS

IMPROVEMENTS, SUGGESTIONS FOR. Industrial Relations, Carleton F. Brown. Indus. Management, vol. 64, no. 3, Sept. 1922, pp. 185-188. Suggests principles as forming nucleus for better understanding between capital and labor, and as foundation for development of other policies dictated from time to time by circumstances. Paper read before Indus. Relations Assn.

INSULATORS, HEAT

REFRACTORY. Need for More Refractory Heat Insulators, Robt. D. Pike. Am. Ceramic Soc. Jl., vol. 5, no. 8, Aug. 1922, pp. 554-563, 4 figs. Commercial value of high-temperature thermal insulators, and numerical example of problem in designing flue for conducting hot gases; tentative specifications for refractory and insulating properties, proposed conductometer for measuring thermal conductivity.

2-POINT. New Heat Insulating Material, G. Henry Katz. Am. Soc. Heating & Vent. Engrs. Jl., vol. 28, no. 7, Oct. 1922, pp. 733-738, 2 figs. Describes development structure and composition of 2-Point, made of asbestos and diatomaceous earth, and portrays its effectiveness as heat insulator. Reprinted from Asbestos, June 1922.

INTERNAL-COMBUSTION ENGINES

DESIGN. The Fundamentals of Internal-Combustion-Engine Design, L. H. Pomeroy. Soc. Automotive Engrs. Jl., vol. 11, no. 4, Oct. 1922, pp. 328-332 and (discussion) 354. Factors affecting performance of four-stroke-cycle engines; thermal efficiency and power obtainable from given engine said to be dependent upon compression-ratio, other things being equal; engine speed and friction losses. Author favours short-stroke engine.

ROTARY, FORCES IN. Forces in Rotary Motors, Karl H. White. Mech. Eng., vol. 44, no. 10, Oct. 1922, pp. 643-647 and 654. Deals with determination of forces in rotary motor caused by reciprocation of pistons and connecting rods and by rotation of motor as a whole, in which novel methods of calculation are employed.

See also Automobile Engine; Diesel Engines; Gas Engines; Oil Engines.

IRON

ELECTROLYTIC REDUCTION FROM ORE. The Estelle Process, Axel Estelle. Can. Min. Jl., vol. 43, no. 40, Oct. 6, 1922, pp. 672-675. Author describes his process for electrolytic reduction of iron from its ores and points out its advantages.

MECHANICAL PROPERTIES. Mechanical Properties of Commercial Iron, Zay Jeffries and R. S. Archer. Chem. & Met. Eng., vol. 27, no. 14, Oct. 4, 1922, pp. 694-697, 1 fig. Definitions of various terms used in art of testing materials, and discussion of how various circumstances surrounding test affect results on annealed bars of common structural metals.

IRON ALLOYS

ELECTROLYTIC. The Preparation and the Mechanical Properties of Vacuum-Fused Alloys of Electrolytic Iron with Carbon and Manganese, Robert P. Neville and John R. Cain. Am. Electrochem. Soc. advance paper, no. 20, for meeting Sept. 21-23, 1922, pp. 203-218, 2 figs. Describes preparation and mechanical properties of extensive series of very pure alloys of electrolytic iron, carbon, and manganese, whose composition were so chosen as to bring out specific effects on pure iron of additions of carbon and manganese separately or together.

IRON ORE

BRITISH EMPIRE. The Iron-Ore Reources of the British Empire, Henry Louis. Min. Mag., vol. 27, no. 3, Sept. 1922, pp. 137-143. Includes abstract of report on iron-ore reserves of United Kingdom published by Iron and Steel Committee of Imperial Mineral Resources Bur.

IRRIGATION

DRAINAGE DITCHES, RIO GRANDE. Drainage Ditches for Rio Grande Irrigation Project, L. M. Lawson. Eng. News-Rec., vol. 89, no. 14, Oct. 5, 1922, pp. 574-575, 5 figs. Reclamation of lands spoiled by seepage and alkali from excess irrigation. Cost of contract and force work.

L

LABOR

TWO-SHIFT SYSTEM. The Twelve-Hour Shift in American Industry. Management Eng., vol. 3, no. 4, Oct. 1922, pp. 205-212, 3 figs. Summary report of special committee of Am. Engineering Council, purpose of which is to show extent of two-shift work and experience of those manufacturers who have changed from two-shift operation to some other system.

LIGHTING

GAS, HIGH-PRESSURE. Factory Lighting by High-Pressure Gas, F. C. Tilley. Gas Jl., vol. 159, no. 3094, Aug. 30, 1922, pp. 105-106, 1 fig. Points out advantages of high-pressure gas, and describes special features of Tilley lamps, recommended for use in plants requiring high-temperature heating for double purpose of lighting and heating.

LOCOMOTIVE BOILERS

TUBES. Application and Maintenance of Locomotive Boiler Tubes, G. H. Woodroffe and C. E. Lester. Ry. Rev., vol. 71, no. 10, Sept. 2, 1922, pp. 300-311, 8 figs. Practical suggestions recommended, based on best practice observed on number of railroads.

WATER CIRCULATION. Increasing Locomotive Boiler Efficiency by Proper Circulation of Water, F. G. Lister. Boiler Maker, vol. 22, no. 9, Sept. 1922, pp. 256-257. Notes on Thermic syphon, Harter circulating plate, washout and refiling system. (Abstract.) Paper read before Int. Fuel Assn.

LOCOMOTIVES

BOOSTER. Dynanometer Tests of the Locomotive Booster. Ry. Mech. Engr., vol. 96, no. 10, Oct. 1922, pp. 562-565, 8 figs. Severe trials carried out at Engineering School of Harvard University demonstrate reliability at heavy loads and high speeds. Maximum drawbar pull 11,000 lb.

BRITISH VS. AMERICAN. British and American Locomotive Design and Practice. Come Comparative Comments Thereon from Practical Experience, P. C. Dewhurst. Inst. Mech. Engrs. Proc., vol. 1, no. 3, 1922, pp. 375-423 and (discussions) 424-521, 18 figs. Author discusses comparative methods and practices in regard to structural and detail design, and indicates what in his opinion are best features of two partly opposing systems of locomotive engineering.

DESIGN. Avoidable Waste in Locomotive Operation as Affected by Design, James Partington. Assn. Chinese & Am. Engrs. Jl., vol. 3, no. 4, Apr.-May, 1922, pp. 16-21. Study of design with regard to fuel economy, minimum weight of motive-power equipment, and minimum cost of repairs.

INTERNAL-COMBUSTION. Gasoline Switching Locomotive with Hydraulic Drive. Ry. Mech. Engr., vol. 96, no. 9, Sept. 1922, pp. 503-506, 7 figs. Universal oil transmission governs speed and direction and is said to give remarkable flexibility of control.

MOUNTAIN-TYPE. Service Records of U.P. Mountain Type Locomotives, Ry. Age, vol. 73, no. 16, Oct. 14, 1922, pp. 687-689, 6 figs. Performance indicates that no. 7000 exceeds both theoretical starting and horsepower capacity. Weighs 345,000 lb. and develops 3500 hp. at 50 mi. per hr. See also Ry. Rev., vol. 71, no. 16, Oct. 14, 1922, pp. 509-514, 14 figs.

POWER ESTIMATION. Locomotive Power. E. C. Poultney. Engineer, vol. 134, no. 3480, Sept. 8, 1922, pp. 248-250, 6 figs. Describes method of quickly obtaining probable drawbar pull of any steam locomotive of conventional design at all speeds usual in practice.

Steam Desaturators. Steam Desaturators Applied to Hungarian Motive Power, Desider Ledacs Kiss. Ry. Rev., vol. 71, no. 05, Oct. 1, 1922, pp. 475-478, 6 figs. Describes Stein desaturator, a water intercepting device located in steam dome, successfully applied to large number of foreign locomotives. Improves locomotive efficiency in bad-water district.

LUBRICANTS

Oiliness. The Measurement of the Property of Oilliness, Robert E.Wilson and Daniel P. Barnard. Soc. Automotive Engrs. Jl., vol. 11, no. 2, Aug. 1922, pp. 143-157, 17 figs. Describes variety of possible methods of measuring property of oiliness and of throwing light on mechanism of partial lublication. It is concluded that static-friction test with proper refinements is best single measure of properties of oiliness.

LUBRICATION

Bearings. Bearing Design and Lubrication, William Foot. Elec. Jl., vol. 09, no. 9, Sept. 1922, pp. 367-382, 18 figs. Notes on action of oil films, and of a perfect film; starting conditions; application of lubricant; methods of cooling; oil protection; bearing losses and temperature; insulation of bearing pedestals; protection from dust, dirt and scale.

Plant. The Technical Supervision of Plant Lubrication, Allen F. Brewer. Indus. Management, vol. 64, nos. 3 and 4, Sept. and Oct. 1922, pp. 141-144 and 221-223, 6 figs. Suggestions to plant lubricating engineer. Determination of correct lubricant and minimum amount to use for safe and uninterrupted operation.

M

MACHINE SHOPS

Standardized Equipment. Standardizing machine Shop Equipment, H. L. Wheeler. Am. Mach., vol. 57, no. 14, Oct. 5, 1922, pp. 520-521, 3 figs. Advantages are said to justify cost; successful method of improving old tools; tapers reduced to one standard and two sizes.

MACHINE-TOOLS

Chip Disposal. Chip Disposal, F. Horner. Eng. Production, vol. 5, no. 102, Sept. 14, 1922, pp. 247-251, 17 figs. Notes on shape of edge and chip escape; objection to large chips; packing in slots and holes; interference with machine elements; chip-collecting removing devices; chip accommodation in flutes; guards and receptacles; fixed pans versus portable; storage within machine framings.

MALLEABLE CASTINGS

Handling. Handling Malleable Castings, Herbert R. Simonds. Foundry, vol. 50, no. 18, Sept. 15, 1922, pp. 733-736, 4 figs. Methods adopted in prominent Eastern foundry, including use of lift trucks and raised platforms, which have expedited work and reduced operating expenses.

Standardization. The Status of Standardization of Gray-Iron and Malleable Castings (Bericht über den Stand der Normung von Grau- und Temperguss), Rudolf Stots. Giesserei-Zeitung, vol. 19, no. 37, Sept. 19, 1922, pp. 537-544, 15 figs. Critical discussion of quality regulations for gray-iron castings. Proposals for quality regulations for malleable iron. Foreign standards. Address before Assn. German Foundrymen.

MANGANESE STEEL

Castings. Pearlitic and Sorbitic Manganese Steels, John H. Hall. Iron Age, vol. 110, no. 13, Sept. 28, 1922, pp. 786-788. Plea for castings containing about 1 per cent manganese. Their heat treatment and properties. Review of literature on subject.

MAPPING

Aerial Photography. Air Photos as Plane-Table Sheets Aid Mapping, Harold C. Fiske. Eng. News-Rec., vol. 89, no. 14, Oct. 5, 1922, pp. 552-554, 2 figs. Studies made along Knoxville to Chattanooga section of Mississippi River. Contours accurately sketched in by field party. Method is said to supply wealth of detail.

MARINE BORERS

Research. The Marine Borer: Some New Light. Pacific Mar. Rev., vol. 19, no. 8, Aug. 1922, pp. 452-453, 10 figs. Work of San Francisco Bay marine milling committee leads to complete reversal of ideas regarding pest. Neither fresh water nor sewage immediately destructive.

METALLOGRAPHY

Eutectics, Structure of. The Structure of Eutectics, F. L. Brady. Inst. Metals advance paper for meeting Sept. 20-22, 1922, 45 pp., 32 figs. Notes on eutectic grain; classification of eutectics and form of lamellae; experimental details; bibliography. Photomicrographs.

METALS

Mechanical Properties. Effect of Temperature, Pressure and Structure on Mechanical Properties of Metal, Zay Jeffries and R. S. Archer. Chem. & Met. Eng., vol. 27, no. 15, Oct. 11, 1922, pp. 747-751, 5 figs. Study of mechanical properties of single crystals.

Mechanical Properties As Affected by Grain Size, Zay Jeffries and R. S. Archer. Chem. & Met. Eng., vol. 27, no. 16, Oct. 18, 1922, pp. 789-792, 2 figs. Points out that grain boundaries add certain stiffness to metallic aggregate; fine grain therefore generally involves higher tensile strength and hardness, and greater reduction aera; maximum elongation requires medium grain size.

Polishing. Principle of Metal Polishing, Bradford H. Divine. Machy. (N. Y.), vol. 29, nos. 1 and 2, Sept. and Oct. 1922, pp. 12-13 and 134-135, 2 figs. Sept.: General principles of metal polishing, polishing wheels and abrasives, methods and equipment, and making of polishing wheels. Examples of polishing practice. Oct.: Properties of glue for polishing wheels.

MILLING

Locomotive Main Rods. Milling Locomotive Main Rods. Machy. (N. Y.), vol. 29, no. 2, Oct. 1922, pp. 98-101, 8 figs. Results of tests made to determine possibilities of reducing costs in railroad shops by milling.

MINE LOCOMOTIVES

Types, Comparison of. Relative Merits of Mine Locomotives, C. E. Rogers. Elec. World, vol. 80, no. 14, Sept. 30, 1922, pp. 708-711, 1 fig. Report of committee on relative merits of storage-battery, combination, and conductor-cable-reel gathering locomotives. (Abstract.) Report read before W.-Va.-Ky. Assn. of Mine, Mech, & Elec. Engrs.

MINES

Ventilation. Metal Mine Ventilation in the Southwest, Chas. A. Mitke. Am. Inst. Min. & Met. Engrs. Trans., no. 1191-M, Oct. 1922, 27 pp.; also (abstract) in Min. & Metallurgy, no. 190, Oct. 1922, pp. 35-36. Describes ventilation systems and their need, especially in deep mines containing high sulphide ores and in mines where caving systems of mining are used, and deals with alloying rock dust, and relation of mining methods to ventilation systems.

MOTOR BUSES

Trolley. The Railless Trolley Bus. Indian Industries & Power, vol. 19, no. 11, July 1922, pp. 405-407, 6 figs. Details of bus produced by Assoc. Equipment Co., Ltd.

MOTOR TRUCKS

Weight Reductions. Notes on Motor Trucks, Cornelius T. Myers. Soc. Automotive Engrs. Jl., vol. 11, no. 4, Oct. 1922, pp. 333-341 and (discussion) 341-345, 12 figs. Author outlines reasons why weight reductions are very difficult to effect, as well as possibilities of standardizing axle details. Use of aluminum to effect weight reduction and various advantages claimed for metal wheels are commented upon. Account of series of tests conducted by large coal company to determine relative merits of wood and metal wheels on its trucks. Discusses question of unsprung weight.

N

NICKEL ALLOYS

Non-Ferrous. The Influence of Carbon in Non-Ferrous Nickel Alloys. Metal Industry (Lond.), vol. 21, no. 9, Sept. 1, 1922, p. 195, 2 figs. Points out importance of using only nickel that is as nearly carbon-free as commercial nickel can be. Nickel made by Mond process is said to comply most closely with this condition.

Properties. Nickel and Its Alloys, Paul D. Merica. Am. Mach., vol. 57, nos. 11, 12 and 13, Sept. 14, 21 and 28, 1922, pp. 397-399, 3 figs.; 450-452, 4 figs., and 484-487, 2 figs. Sept. 14: Commercial uses of malleable nickel; how various percentages of nickel affect steel; production of copper-nickel alloys. Sept. 21: Properties and uses of nickel-silver and monel metal; how monel metal should be melted, cast and forged. Sept. 28: Special tools for cutting monel metal; how it should be worked and finished; alloys for electrical and heat-resisting uses.

NITROGEN

Fixation. Nitrogen Fixation by the Cyanide Process, F.E. Bartell. Jl., Indus. & Eng. Chem., vol. 14, no. 8, Aug. 1922, pp. 699-704, 6 figs. Results obtained with 4-in. batch retorts with capacity of 8 lb. of briquets and with technical sized 8-in. continuous retorts, with maximum cyanizing capacity of not less than 50 lb. of cyanized briquets per hr.

NON-FERROUS METALS

Superheated Steam Effect on. The Effect of Superheated Steam on Non-Ferrous Metals Used in Locomotives, Henry Fowler. Inst. Metals advance paper for meeting Sept. 20-22, 1922, 4pp., 2 figs. Experience and practice with regard to chief parts subjected to superheated steam in case of superheated locomotives on Midland Ry. Photomicrographs. See also Engineering, vol. 114, no. 2960, Sept. 22, 1922, p. 374-2 figs.

O

OIL ENGINES

Airless-Injection. Hesselman Airless Injection for Small and Large Oil Engines. Edvin Lundgren. Motorship, vol. 7, no. 10, Oct. 1922, pp. 766 and 769, 7 figs. Details of method devised by K. J. E. Hesselman on 65-hp. on engine.

Production of Workboat Oil-Engines in the East. Motorship, vol. 7, no. 10, 1922, pp. 764-765, 7 figs. Details of new Wolverine airless-injection four-cycle marine engine.

Solid-Injection. A Swedish Solid Injection Oil Engine, Engineer, vol. 134, no. 3482, Sept. 22, 1922, pp. 290-292, 11 figs. Describes Hesselman engine, special features of which are fuel pump which receives fuel from separate feed pump connected to effective filter; governing and fuel-distributing mechanism, intimately combined with fuel pump; fuel piping; and fuel-injection valve. Translated from article in Swedish publication, by E. Hubendick.

OIL FUEL

Burners. A New Fuel Oil Burner, Arthur Grounds. Oil Eng. & Finance, vol. 2, no. 35, Sept. 1922, pp. 284-285, 3 figs. Describes Meldrum burner for which low steam consumption is claimed. Is modification of steam slot type of burner.

INSTALLATION, SINGER BUILDING. Fuel Oil Shows Big Saving in Singer Building, Norman King. Power, vol. 56, no. 10, Sept. 5, 1922, pp. 348-352, 6 figs. Two years' operation has shown 34-per cent saving over coal and installation paid for itself in 21 months. Details of construction necessary to meet Building and Fire Department's regulations.

OIL

APPRAISAL OF PROPERTIES. Appraisal of Oil and Gas Properties, Roswell H. Johnson. Engrs.' Soc. West. Pa. Proc., vol.38, no. 2, Mar. 1922, pp. 35-43 and (discussion) pp. 44-45. Author urges wide use of production-curve method of appraisal, sometimes called annual analytic method.

OILS

VISCOSITY. Notes on Determination of Absolute Viscosity of Petroleum Oils, W. H. Fulweiler and C. W. Jordan. Jl. Indus. & Eng. Chem., vol. 14, no. 8, Aug. 1922, pp. 723-724. Results of examination of samples of petroleum, animal and vegetable oils. Paper read before Am. Chem. Soc.

The Change in Viscosity of Oils with the Temperature Winslow H. Herschel. Jl. Indus. & Eng. Chem., vol. 14, no. 8, Aug. 1922, pp. 715-723, 12 figs. Author claims there is no satisfactory theoretical equation for change of viscosity with temperature. Discusses methods of calculation in use. Paper read before Am. Chem. Soc.

OIL WELLS

DRILLING. Taking cores in Rotary Drilling Operation, John R. Suman. Min. & Metallurgy, no. 190, Oct. 1922, pp. 21-24, 7 figs. Notes on use of basket-type and auger-type barrel; advantages of Reed & Hepler coring tool; Oil-fields- Hulland core bid; Knapp core barrel; future of reaming-type coring tools.

OXY-ACETYLENE CUTTING

MECHANICAL CONTROL OF TORCH. Mechanical Control of Oxy-Acetylene Torch, Fred J. Meurer. Can. Machy., vol. 27, no. 26, and vol. 28, no. 2, June 29 and July 13, 1922, pp. 27-28 and 28-29, 12 figs. Cutting metal by this process approaches very closely maximum theoretical efficiency; obtaining any desired shape by means of templates; application of radiographs.

OXY-ACETYLENE WELDING

CAST IRON. Principles of Oxy-acetylene Fusion Welding, Alfred S. Kinsey. Ry. Mech. Engr., vol. 96, no. 10, Oct. 1922, pp. 595-597, 2 figs. Welding cast iron.

RAILWAY REPAIRS. Application of the Welding Torch to Railroad Repairs. Am. Mach., vol. 57, no. 12, Sept. 21, 1922, pp. 444-448, 17 figs. It is claimed that welding torch reduces cost of repairs; locomotives need not be dismounted; salvage of many small parts possible.

P

PAINTING

SPRAY. Spray Painting and Finishing by Compressed Air, Ray W. Tripp. Can. Machy., vol. 28, no. 13, Sept. 28, 1922, pp. 28-29, 6 figs. Spraying method said to maintain quality and reduce production costs; one advantage is that ess scaffoldimg is required on high structures.

PILES

WOOD IN CONCRETE. Bond Strength of Wood Piles in Concrete, R. R. Lundahl. Am. Soc. Civ. Engrs. Proc., vol. 48, no. 8, Oct. 1922, pp. 1653-1664, 2 figs. Discusses conditions which necessitated determining bond strength in connection with design of new sewage-disposal plant for Milwaukee, Wis., and gives detailed account of tests, test specimen and apparatus.

PIPE

LEAD, SELF-CORROSION OF BURIED. The Self-Corrosion of Buried Lead Pipes, W. Nelson Smith and J. W. Shipley. Eng. Jl. (Eng. Inst. Can.), vol. 5, dos. 6 and 7, June and July 1922, pp. 291-296, and 259-364, 3 figs. Investigation of corrosion of buried lead pipes in Winnipeg and vicinity, with laboratory experiments on self-corrosion of lead.

PIPE, CAST-IRON

DE LAVAUD PROCESS. Casting Pipe Without a Core. Gas Age-Rec., vol. 50, no. 11, Sept. 9, 1922, pp. 327. Describes the De Lavaud process of casting gas and water pipe, with tests as made by Prof. Peter Gillespie in laboratories of University of Toronto.

PIPE, CONCRETE

FRICTION IN. The Frictional Coefficient of Concrete Surfaces in Pipe and Channels. E. Parry. Engineering, vol. 114. no. 2958, Sept. 8, 1922, pp. 285-286, 2 figs. [illegible] F. C. Scobey on flow of water in concrete pipes, published by U. S. Dept. of Agriculture,and other works.

PLANERS

DRIVES. [illegible] Machy. (Lond.), vol 20, no 522, Sept. 28, 1922, pp. 777-782, 4 figs. Characteristics of various types, including, ordinary belt-driven planers, clutch and shifting belt planers, direct-coupled reversing motor, magnetic-clutch, Newton (Derby) planer, and hydraulic drive.

PLATES

CIRCULAR, STR[illegible] a Circular Plate the Thickness of which is not uniform, Keiichi Aichi. Soc. Mech, Engrs. Tokyo, Japan—Jl., vol. 25, no. 74 [illegible] 61-71, [illegible] strength of circular plate whose thickness is function of distance from its center.

DEFLECTION. The Deflection of Continuous Plates and Rectangular Plates with Free Edges (Biegung durchlaufender Platten und rechteckiger Platten mit frein Rändern), A. Nadai. Zeit. des Vereines deutscher Ingeneiure, vol. 66, no. 36, Sept. 9, 1922, pp. 848-849, 3 figs. Deals with girderless ceilings supported by columns in a rectangularly arranged trellis work of points. Discusses deformation and stress of such continuous plates and state of bending in separate points on edge of unsupported rectangular plates.

PNEUMATIC TOOLS

AIR-CLEANING APPARATUS FOR. Air Compressing and Cleaning Apparatus. Machy. (Lond.), vol. 20, no. 520, Sept. 14, 1922, p. 739, 2 figs. Describes apparatus, comprising belt-driven compressor, air cooler, oil separator and air receiver for purpose of removing oil and moisture and also solid particles with which free-air supply is usually impregnated.

POWER FACTOR

LOW. Power Factors. Elec. Times, vol. 61. nos. 1601 and 1602, June 22 and 29, 1922, pp. 601-605 and 639-641, 7 figs. Notes on low power factors; their prevention and remedy; dealing with English and French conditions; metering method discussed.

POWER PLANTS

EQUIPMENT. Distinctive Power Plant Equipment, J. H. Blakey. Power Plant Eng., vol. 26, no. 19, Oct. 1, 1922, pp. 959-961, 5 figs. Describes the Gaillet continuous water purifier; use of corrugated piping; Ruth's steam accumulator Paradox boiler-tube cleaner.

HARVARD MEDICAL SCHOOL. Power Plant of the Harvard Medical School, Boston, Mass., Charles L. Hubbard. Power, vol. 56, no. 13, Sept. 26, 1922, pp. 482-486, 5 figs. Details of plant supplying light heat and other services to group of 35 buildings having total space of 13,000,000 cu. ft. Equipment includes eight 3000-sq. ft. Stirling boilers, four of which are oil-burning 3 d. c. units with total capacity of 725 kw. and several auxiliaries.

INDUSTRIAL. Power Plant of the Duratex Company Has Many Interesting Features. Power, vol. 56, no. 10, Sept. 5, 1922, pp. 358-362, 7 figs. Plant of 625-kva. has one boiler of 3330 sq. ft. of heating surface and one turbo-generator. Boiler is operated up to 350 per cent of normal rating, is fired by automatic stoker and coal is weighed in weighing larry.

POWER TRANSMISSION

MECHANICAL. Mechanical Transmission of Power, Forrest E. Cardullo and Franklin D. Jones. Machy. (N.Y.), vol. 29, no. 2, Oct. 1922, pp. 85-89, 4 figs. Design and installation of shafting and belt and chain transmission.

PROSPECTING

ELECTRICAL. Experiments in Electrical Prospecting, Sherwin F. Kelly. Eng. & Min. Jl.-Press, vol. 114, nos. 15 and 16, Oct. 7 and 14, 1922, pp. 623-629 and 673-676, 20 figs. Description of experiments and results in various metal mines in eastern and northern United States and southern Canada with "Spontaneous polarization" method, so called by Prof. Schlumberger. Coal also subject to satisfactory tests. Value of method is principally in premilinary determination of advantageous locations for diamond drilling.

PULVERIZED COAL

PNEUMATIC CONVEYING. Conveying Fuel in the Form of Dust by Means of Gas (Beförderung stambförmiger Brennstoffe durch Gasleitungen), Wittfeld. Fördentechnik u. Frachtverkehr, vol. 15, no. 19, Sept. 15, 1922, pp. 247-248, 8 figs. Proposes transportation of semi-coke after grinding in gas lines and separating coal dust and gas on arrival at boilerhouse.

UTILIZATION. The Utilization of Pulverized Coal J. Thomas Dovey and George N. Calkins. Can. Inst. Min. & Metallurgy Monthly Bul., no. 125, Sept. 1922, pp. 992-1001. Central distributing systems; oilburning equipment convertible to burning of powdered coal; principles of use; economies; effected present status of industry.

PUMPING

SOLID-MATERIAL TRANSPORTATION OF. Transportation of Solid Material by Pumping, Victor J. Milkowski, Cement Mill & Quarry, vol. 21, no. 6, Sept. 20, 1922, pp. 23-26, 8 figs. Water supply in proportion to amount of solids to be moved dewatering material at destination; cheap and ample fuel supply a requisite.

PUMPS

CALCULATION. A Calculation System for Pumps, Terrell Croft. Coal Industry, vol. 5, nos. 8 and 9, Aug. and Sept. 1921, pp. 350-353 and 399-402, 16 figs. Aug.; Suction lifts said to be possible under practical conditions. Study of pump heads. Formulas for determining total friction, velocity and measured heads. Sept.: Friction of water in wrought-iron, steel, and cast-iron pipe; frictional resistances in fittings and valves.

PUMPS, CENTRIFUGAL

CURVES. Centrifugal Pumps, E. T. Keenan. Southern Engr., vol. 37, no. 6, Aug. 1922, pp. 55-56, 3 figs. Characteristic curves of various types.

MECHANICS. Mechanics of Centrifugal Pumps, E. T. Keenan. Southern Engr., vol. 38, no. 2, Oct. 1922, pp. 52-55, 3 figs. Elementary mechanics principally laws of motion.

PISTON VS. Piston and Centrifugal Pumps (Kolbenpumpe und Kreiselpumpe als Wasserhaltungsmaschine), A. P. Mössner, Fördertechnik u. Frachtverkerh, vol. 15, nos. 18 and 19, Sept. 1 and 15, 1922, pp. 235-242 and 254-257, 8 figs. Historic development; electric drive; efficiency of quadruple-action piston and centrifugal pumps of same capacity; superiority of electrically driven centrifugal pumps; comparative tables of efficiency of plunger and centrifugal pumps.

PYROMETERS

OPTICAL. An Optical Pyrometer for Practical Use in the Foundry (Optisches Pyrometer für den praktischen Gebrauch in der Giesserei), H. Retzow. Giesserei-Zeitung, vol. 19, no. 36, Sept. 12, 1922, pp. 528-529, 5 figs. Details, manipulation, measuring principle advantages and uses of the AEG (German Gen. Elec. Co.) pyrometer.

See also Wärme, vol. 45, no. 33, Aug. 25, 1922, p. 401, 3 figs.

R

RADIO COMMUNICATION

Heterodynes. On Heterodynes, P. R. Coursey, Wireless World, vol. 10, nos. 6, 7, 9, 10 and 27, May 6, 13, 27, June 3, and Sept. 30, 1922, pp. 161-163; 194-197, 252-255, 279-281 and 845-853, 41 figs. Some advantages, especially for longer wave lengths of separate heterodyne oscillator and directions for building simple forms of apparatus. Sept. 30: Construction of heterodyne wavemeter.

RADIOTELEGRAPHY

Power Provision. The Provision of Power for Wireless Telegraphy, J. H. Whittaker-Swinton. Instn. Elec. Engrs. Jl., vol. 60, no. 311, July 1922, pp. 845-852 and (discussion) 852-860, 10 figs. Survey of various forms of power at high tension used in connection with continuous-wave wireless telegraphy in early stages of development; examination of present practice in experimental working in connection with transmitting sets of small power; statement as to probabilities regarding future.

Crystal Detectors. The Use of Minerals as Radio-Detectors, H. S. Roberts and L. H. Adams. Am. Mineralogist, vol. 7, no. 8, Aug. 1922, pp. 131-136, 1 fig. Summarizes present state of knowledge concerning crystal-detectors and calls attention to possibilities of improvement and desirability of further research. Bibliography.

RAILWAY ELECTRIFICATION

France. Electrification Work and Projects of the Midi Railway (Travaux et projets d'électrification de la Compagnie des chemins de fer du Midi), Fontaine. Annales des Ponts et Chaussées, vol. 1, no. 3, May-June 1922, pp. 277-295, 3 figs. Hydro-electric-power production in Pyrenees; equipment of power stations; program of electrification; change from single-phase to continuous current to eliminate interference with low-tension lines.

RAILWAY MOTOR CARS

Steam-Propelled. Steam-Propelled Unit Railway Motor Car. Ry. Age, vol. 73, no. 16, Oct. 14, 1922, pp. 711-713, 5 figs. Improved power plant with water-tube boiler and oil burner characterize Canadian national car.

Types. Self Propelled Cars on Steam Railways. Can. Ry. & Mar. World, no. 296, Oct. 1922, pp. 525-527, 6 figs. Details of four self-propelled cars of Can. Nat. Rys. on exhibit at Can. Nat. Exhibition, Toronto, viz., storage-battery car, steam car, and two types of gasoline cars. Results with self-propelled cars in United States. Diesel-electric cars.

Train Control. Automatic Train Control, Frank J. Sprague. Franklin Inst. Jl., vol. 194, no. 2, Aug. 1922, pp. 133-163, 11 figs. Notes on early failures and why greater progress has not been made; general requisites; the Sprague intermittent non-contact system.

Robbing Railroading of Some of Its Hazards. Robert G. Skerrett. Compressed Air Mag., vol. 27, no. 10, Oct. 1922, pp. 273-278, 15 figs. Development of automatic train control, and description of the Sprague system.

The Union System of Automatic Train Control, L. V. Lewis. Ry. Rev., vol. 71, no. 12, Sept. 16, 1922, pp. 371-374 and (discussion) 374-375, 6 figs. Describes system developed by Union Switch & Signal Co. to comply with requirements of road conditions. From paper read before Ry. Club in Pittsburgh.

RAILWAY SIGNALING

Alternating-Current, Power Lines. Overload Protection of A. C. Signal Power Lines, Harry M. Jacobs. Ry. Signal Engr., vol. 15, no. 9, Sept. 1922, pp. 345-346, 3 figs. Purpose of overload devices; transformer and substation protection; high-voltage fuses.

Block System. I. C. C. Statistics and Tables in Signaling, Ry. Signal Engr., vol. 15, no. 9, Sept. 1922, pp. 354-357, 2 figs. Annual report compiled by Bur. of Safety of Interstate Commerce Commission pertaining to block signals in service and percentage of all roads equipped with this system.

Interlocking. New Electric Interlocking on the D. & H., W. G. Burns. Ry. Signal Engr., vol. 15, no. 8, Aug. 1922, pp. 304-306, 10 figs. Rear home signals, concrete trunking and independent power plant are unusual features.

Track Circuits. Direct Current Track Circuits, W. J. Thorrowgood. Am. Ry. Assn. Signal Section, Proc., June 14-16, 1922, pp. A336-A340, 2 tables on supp. plates. Discussion of factors involved in standard of safety for track circuits.

D. C. Track Circuits with Welded Bonds, C. F. Estwick Ry. Signal Engr., vol. 15, no. 10, Oct. 1922, pp. 383-386, 5 figs. Determination of characteristics of relay to be used on long track circuits when cut sections are eliminated.

RAILWAYS

Japan. The Japanese Railways and Their Operating Problems, H. K. Smith. Ry. Rev., vol. 71, no. 12, Sept. 16, 1922, pp. 365-369, 5 figs. History, physical characteristics, and character of service; progress toward electrification.

United States and England. Samuel Rea Compares English and U. S. Railroads. Ry. Rev., vol. 71, no. 15, Oct. 7, 1922, pp. 495-496. Conditions affecting railroads in United States and those of Great Britain. Finds progress abroad in regrouping and believes English carriers must make sacrifices as here. From Phila. Public Ledger.

RAPID TRANSIT

Chicago. Chicago Transportation Experience. Elec. Ry. Jl., vol. 60, no. 13, Sept. 23, 1922. Contains following articles. Carrying a Billion Passengers a Year in Chicago, pp. 419-424, 10 figs. Dealing with the Labor Problem, Britton I. Budd, pp. 425-427. How Car Design has Progressed on Chicago's Rapid Transit Lines, H. A. Johnson, pp. 427-430, 4 figs. Maintaining Chicago "L" Structure, G. M. Anderson, pp. 430-431. Signaling Trains on Chicago Elevated Railroads, J. W. Stephenson, p. 431. How "L" Track is Built to Handle 900,000 Cars a Year, H. P. Savage, p. 432, 1 fig. Utility Insurance, Williston Fish, pp. 433-434. Heating and Ventilating Chicago Street Cars, Charles Gordon, pp. 435-439, 7 figs. Developing Chicago's Street Cars, Wray T. Thorn, pp. 440-444, 3 figs. Experience with Chicago Track, Charles S. Holcomb, pp. 445-452, 10 figs. Development of Unified Power Supply and Distribution Systems in Chicago, Ralph H. Rice, pp. 455-461, 5 figs. Requirements Imposed in Designing North Shore Passenger Cars, H. A. Otis, pp. 470-472, 6 figs. Using Direct Suspension Trolley in High-Speed Train Service, Clifford Huttleston, pp. 473-476, 9 figs. Chicago's Traffic Problem, R. F. Kelker, Jr., pp. 481-484, 10 figs.

REFRACTORIES

Compressive Strength. Volume Constancy and Compressive Strength of Refractory Lining of Boilers and Furnaces (Raumbeständigkeit und Druckfestigkeit der feuerfesten Auskleidung von Dampfkessel- und Feuerungsanlagen), W. Ritter. Feuerungstechnik, vol. 10, no. 23, Sept. 1, 1922, pp. 259-261. Methods and results of tests. See also Wärme-u. Kälte-Technik, vol. 24, no. 16, Aug. 15, 1922, pp. 185-187.

Foundry. Foundry Refractories, H. Winterton. Foundry Trade Jl., vol. 26, no. 318, Sept. 21, 1922, pp. 236-238. Notes on siliceous refractories; question of sands; coal dust; defects caused by lime in sand; grist; blackings; graphitic facings.

REFRIGERANTS

Sulphurous Anhydride. New System of Manufacturing Liquid Sulphurous Anhydride (Nuovo sistema di fabbricazione della anidride solforosa liquida nelle regioni sud-americane), H. J. Paoli. Giornale di Chimica Industriale ed Applicata, vol. 4, no. 8, Aug. 1922, pp. 349-352, 3 figs. Methods used by Sulfurica Co. in Argentina; operation of plant.

REFRIGERATING MACHINES

Air. Air as Refrigerating Agent (Sur l'emploi de l'air comme agent frigorifique), Maurice Leblanc. Revue Universelle des Mines, vol. 14, no. 3, Aug. 1, 1922, pp. 165-200, 16 figs. Describes new cold-air refrigerating machine which from tests proves to be as economical as an ammonia machine.

See also Nature (Paris), no. 2529, Sept. 23, 1922, pp. 203-208, 7 figs.

Ethyl-Chloride. Ethyl Chloride Refrigeration, Charles H. Herter. Refrig. World, vol. 57, no. 9, Sept. 1922, pp. 13-16 and 32, 3 figs. Theoretical heat balance of ethyl chloride refrigerating machines; results of actual tests; horsepower per ton in small machines.

RELAYS

Protective. Ground Relays Improve Protection, L. A. Terven. Elec. World, vol. 80, no. 14, Sept. 30, 1922, pp. 711-714, 12 figs. It is claimed that Isolation of accidentally grounded sections by accurate switch operation can be effected in nearly every case by use of proper combination of protective relays.

RESERVOIRS

Providence, R. I. Constructing Scituate Reservoir. Public Works, vol. 53, no. 7, Sept. 1922, pp. 137-143, 8 figs. Construction of earth dam and dike nearly 1½ miles in combined length to furnish improved water supply for Providence, R. I.; capacity of reservoir to be 36,900,000,000 gal.; 7-mile aqueduct to have capacity of 85,000,000 gal. daily, contractor's modernly equipped camp.

Balancing. A Balancing Reservoir, Wm. A. Megraw. Am. City, vol. 27, no. 3, Sept. 1922, pp. 209-211, 1 fig. Describes so-called balancing reservoir recently completed in connection with Gunpowder River improvements to water supply of Baltimore. Its function is to supply deficiency to pumps when too little water is being admitted to tunnel, and to absorb excess when too much is being admitted.

RESEARCH

Industrial. Research: Its Position in the Making of an Industry, John E. Teeple. Jl. Indus. & Eng. Chem., vol. 14, no. 10, Oct. 1922, pp. 904-905. Discusses Problems in connection with manufacture of decolorizing carbon; cracking heavy petroleum; and manufacture of potash.

ROAD CONSTRUCTION

Automotive Equipment. Automotive Equipment in Road Construction, A. C. Godward. Soc. Automotive Engrs. Jl., vol. 11, no. 4, Oct. 1922, pp. 355-357 and (discussion) 357-358. Notes on renting machinery to project to assure return on equipment. methods of determining depreciation, rental charges and ratio of operating costs to fixed charges. Comparison of author's system with that used by Associated General Contractors. Costs of operation of dump truck, caterpillar tractor and steam-shovel.

ROADS

Expreimental Work. Recent Developments in Highway Research. Good Roads, vol. 62, no. 23, June 7, 1922, pp 314-317. Experimental work on Bates, Arlington and Pittsburgh tests roads. Bur. of Pub. Roads devises new instruments for tests.

Policy. Considerations for a Road Policy, M. A. Lyons. Eng. Jl. (Eng. Inst. Can.), vol. 5, no. 10, Oct. 1922, pp. 504-508. Importance of road question : divisions under which road policy should be considered; types of traffic; exclusive requirements; where control should be placed; financing of roads.

ROADS, CONCRETE

Design. Concrete Pavements, H. C. Boyden. Colo. Sci. Soc. Proc., vol. 11, Jan. 1922, pp. 343-366. Outline of correct principles to be followed in construction of pavement and making of the concrete. Notes on fineness-modulus; designing mixtures of known strength; samples of aggregates; plasticity and water-cement ratio; specifications; improper use of principles; fundamentals other than design.

Bar Reinforcement. The Merits of Bar Reinforcement for Concrete Pavements, W. S. Edge. Good Roads, vol. 63, no. 11, Sept. 13, 1922, pp. 91-93. Investigatiom to determine whether concrete pavements needed reinforcement and if so what was best type and proper amount of steel to use for this purpose.

ROADS, TARRED

Great Britain. Practice in Tar Road Construction in Great Britain. Eng. News-Rec., vol. 89, no. 14, Oct. 5, 1922, pp. 564-566. Tars and surface-tarring procedure. Mixed tar and stone roads. Pitch-grouted or penetration macadam roads.

ROLLING MILLS

Electrically Driven. Electric Blooming Mill Drive, S. N. Roberts. Elec. Jl., vol. 19, no. 9, Sept. 1922, pp. 356-362, 12 figs. Deals with drive of Atlantic Steel Co.'s blooming mill.

PROCESSES. The Mechanical Working of Iron and Steel Walter Buckley. Eng. Jl., (Eng. Inst. Can.), vol. 5, no. 10, Oct. 1922, pp. 499-504, 10 figs. Outline of modern rolling mill practice, describing processes in various types of mills.

STRIP AND HOOP. Combined Strip and Hoop Mill of the Whitehead Iron and Steel Company, Limited. Iron & Coal Trades Rev., vol. 105, no. 2847, Sept. 22, 1922, pp. 417-418, 15 figs. on pp. 433-436. Details of continuous mill combining main features of the Acme and the Morgan continuous skelp mill. First on its type to be built in the world.

New Cold Rolled Strip Steel Plant. Iron Age, vol. 110, no. 15. Oct. 12, 1922, pp. 920-922, 5 figs. Finishing stands driven independently of roughing stands; unusual uniformity obtained in annealing ovens of special design. Details of new rolling mills of Wallingford Steel Co., Conn.

S

SAFETY

CODES. Preparation of Safety Codes Under the Auspices of the American Engineering Standards Committee, Morton C. Lloyd. Monthly Labor Rev., vol. 15, no. 3, Sept. 1922, pp. 1-8, 1 fig. It is shown that American Engineering Standards Committee with co-operation of Safety Code Correlating Committee, furnishes machinery for formulation of safety codes in manner which will insure thorough consideration of viewpoint of various interests concerned with safety codes.

SAND, MOLDING

SCREEN TESTS. Analyzes Sand Screen Tesas, H. A. Schwartz. Foundry, vol. 50, no. 18, Sept. 15, 1922, pp. 752-756, 7 figs. Mathematical investigations indicate effect of grains of different shapes and sizes on previousness of molding sand; method of testing; conclusions. Paper read before Am. Foundrymen's Assn.

TESTING. The Testing of Moulding Sands, Ernest J. Davis. Metal Industry (Lond.), vol. 21, nos. 10 and 11, Sept. 8 and 15, 1922, pp. 219-221 and 243-247, 6 figs. Describes how laboratory testing may be carried out. Notes on chemical, mechanical and mineral analysis; bonding strength, mechanical strength of sand molds and cores; thermal conductivity, permeability, porosity and microscopic examination.

SANITATION

TOWN AND REGIONAL PLANNING. Town and Regional Planning in Relation to Sanitation, R. O. Wynne-Roberts. Contract Rec., vol .36, no. 36, Sept. 6, 1922, pp. 879-881. Discusses problems of water supply and sewerage with particular reference to Toronto and district. Suggestions for administration of these services. From Jl. of Town Planning Inst.

SCREW THREADS

MILLING. The Milling of Screws and Other Problems in the Theory of Screw-Threads, H. H. Jeffcott. Instn. Mech. Engrs. Proc., vol. 1, no. 3, 1922, pp. 515-528 and (discussion) 529-562, 19 figs. Account of problems of interest to manufacturer and meteologist.

NORMAL THICKNESS OF WORM-GEAR. The Normal Thickness of a Worm Thread, E. A. Limming. Machy. (Lond.), vol. 20, no. 519, Sept. 7, 1922, pp. 707-708, 1 fig. Geometrical consideration involved in finding true normal thickness.

TOLERANCES. Interchangeable Threaded Work. Engineering, vol. 114, nos. 2959 and 2960, Sept. 15 and 22, 1922, pp. 320-321 and 352-354, 12 figs. Brief survey of practical and theoretical requirements of screw threads and consideration of problems of tolerances. Presents tables of effective diameter tolerances recommended by Alfred Herbert Ltd., for all screw threads to English measurements having thread angle of 55 or 60 deg., and for all metric threads having thread angle of 53 8 to 60 deg ; and recommended for British Assn. screw threads.

SEWAGE DISPOSAL

TREATMENT FOR. Some Recent Experiences in the Process of Sewage Disposal, J. W. Haigh Johnson. Can. Engr., vol. 43, no. 12, Sept. 19, 1922, pp. 367-369. Activated sludge process; zoological character of sludge; experiments on gas evolved during purification; intensity and rate of oxidation. Paper read before Assn. of Mgrs. of Sewage Disposal Wks.

PLANTS. Survey of Sewage Treatment Plants, H. H. Wagenhals. Contract Rec., vol. 36, no. 39, Sept. 27, 1922, pp. 951-953. Result of investigation aiming to secure data on which efficiency could be judged and to suggest standard test and make results at different plants comparable. (Abstract.) From Pub. Health Reports.

SHAFTS

Bending Moments. Bending Moments in Pins or Shafts Determined Graphically, A. M. Winslow. Eng. News-Rec., vol. 89, no. 14, Oct. 5, 1922, pp. 568-569, 3 figs. Effect of forces in different planes expressed by composite moment diagram. Maximum movement found by inspection.

SOLIDS

ELECTRON THEORY OF. An Electron Theory of Solids, J. J. Thomson. Franklin Inst. Jl., vol. 194, no. 3, Sept. 1922, pp. 281-289, 4 figs. Points out that electronic theory of constitution of atom leads quite simply and directly to theory of [illegible] tested, agrees remarkably well with facts.

FAILURE DUE TO STRESS. Laws of Failure of Solid Bodies Due to Stress, Chidô Sunatani. Soc. Mech. Engrs., Tokyo, Japan—Jl., vol. 25, no. 74, June 1922, pp. 1-37, 50 figs. Investigation of laws by which elastic limit and ultimate failure of solid [illegible] stress may be determined.

STANDARDIZATION

FRANCE. Permanent Standardization Committee (Commission permanente de Standardisation [illegible] no. 21, May 25, 1922, pp. 749-750. [illegible] Standardization of dimensions; choice of units; etc.

Permanent Standardization Committee (Commission permanente de Standardisation), Sigma. Métallurgie, vol. 54, no. 36, Sept. 7, 1922, pp. 1311-1313. Plans recently submitted to public discussion on standardization of copper and aluminum buzz bars for switchboards; aluminum wire and cables; and specifications for supplying platinum, platinum-copper, platinum-iridium and platinum-chloride.

MECHANICAL CONSTRUCTION. Standardization of Dimensions in Mechanical Construction (Sur la normalisation des dimensions des éléments de la construction mécanique), F. Bayle. Revue Générale de l'Electricité, vol. 12, no. 10, Sept. 9, 1922, pp. 345-352, 4 figs. Arithmetic and geometric units; practical measures which should be given preference; importance of adoption of standard measures of length.

STEAM

HIGH-PRESSURE. High-Pressure Steam-Heating Lines, Edgar Buckingham. Mech. Eng., vol. 41, no. 10, Oct. 1922, pp. 641-642. Effect of throttling through reducing valve or steam motor; economy of generating steam at high pressure and transmitting it through small line with large line drop.

STEAM ENGINES

ROLLING-MILL RECIPROCATING. Rolling Mill Engine of 25,000 Horse Power. Power House, vol. 15, no. 19, Oct. 5, 1922, pp. 19-20, 2 figs. Built on marine lines for hardest kind of land service; working at full power it reverses four times per min.; three-cylinder but not compound.

UNIFLOW. Another Corliss Engine Firm Building Uniflow Engines. Power, vol. 56, no. 16, Oct. 17, 1922, pp. 600-601, 5 figs. Uniflow engines being built by Murray Iron Works Co. in powers ranging from 75 to 650 i.hp., of side crank bored guide horizontal design.

VALVE GEARS. Engines at Baltimore Refinery Have Unusual Valve Gear. Power, vol. 56, no. 13, Sept. 26, 1922, pp. 498-499, 5 figs. Twin engines 26 by 32 in., operating at 135 r.p.m., direct connected to 1250-kw. d.c. generator.

STEAM GENERATORS

ELECTRIC. Electric Steam Generators and Their Application, P. S. Gregory. Am. Electrochem. Soc. advance paper, no. 12, for meeting Sept. 21-23, 1922, pp. 97-108, 5 figs. Commercial application of electric energy for production of steam by means of water-resistance type of electric steam generators.

STEAM POWER PLANTS

FUEL ECONOMY. Fuel Economy in Steam Power Plants, John B. C. Kershaw. Beama, vol. 11, nos. 2, 3, and 4, Aug., Sept. Oct., 1922, pp. 538-545, 6 figs., 617-625, 7 figs. and 671-681, 11 figs. Aug.: Present-day methods of burning fuel and their defects. Sept.: Improved methods of burning fuel. Oct.: Utilization of waste heat from steam boilers.

STEEL

ALLOY. *See Alloy Steels.*

ELASTIC LIMIT. Elastic Limit and Permanent Deformation of Steels by Multiple Forces (Limite élastique et déformation permanente des aciers dans le cas de forces multiples), E. Malaval. Technique Moderne, vol. 14, nos. 7 and 8, July and Aug. 1922, pp. 289-296 and 345-350, 21 figs. Elastic limit for metals subjected simultaneously to traction and compression; resistance to rupture of cylindrical tubes; effect of simple and compound leads. Bibliograpgy.

FLOW AT LOW RED HEAT. Experiments on the Flow of Steels at a Low Red Heat with a Note on the Scaling of Heated Steels, J. H. S. Dickenson. Iron & Coal Trades Rev., vol. 105, no. 2845, Sept. 8, 1922, pp. 327-331, 15 figs. (Abstract). Paper read before Iron & Steel Inst. See also Engineering, vol. 114, nos. 2959 and 2960, Sept. 15 and 22, 1922. pp. 326-329 and 378-379, 21 figs.

LAG. On the Diminution of Lag at Arl Through Deformation, J. H. Whiteley. Engineering, vol. 114, no. 2961, Sept. 29, 1922, p. 416, 6 figs. Evidence is given that when steel, in metastable region at Arl point is worked, lag is markedly diminished. Paper read before Iron and Steel Instn.

MANGANESE. *See Manganese Steel.*

TESTING. Rapid Determination of Elongation and Resistance to Impact of Steels by Doubling Over a Notched Bar (Détermination, rapide de l'allongement et de la résistance au choc des aciers, par pliage d'un barreau entaillé), L. Jannin. Bul. de la Société d'Encouragement pour l'Industrie Nationale, vol. 134, no. 7, July 1922, pp. 646-656, 7 figs. Results of tests.

TOOL. *See Tool Steel.*

STEEL CASTINGS

ALLOY, MANUFACTURE OF. Alloy Castings from Electric Furnaces, Larry J. Barton. Iron Age, vol. 110, no. 13, Sept. 28, 1922, pp. 784-786, 1 fig. Describes manufacture. properties and heat treatment of nickel, chromium and chrome-nickel steel. Practice of Los Angeles Foundry Co.

STEEL, HEAT TREATMENT OF

LEAD-POT FURNACE. Heat Treating in Lead, R. B. Schenck. Am. Soc. for Steel Treating, Trans., vol. 2, no. 12, Sept. 1922, pp. 1203-1212. It is concluded that greatest argument for lead-pot furnace is high quality of treated product resulting from uniform and accurate temperatures.

NICKEL-CHROMIUM. Heat Treating Changes Volume, Leslie Aitchison and G. R. Woodvine. Iron Trade Rev., vol. 71, no. 14, Oct. 5, 1922, pp. 915-918, 5 figs. Experiments conducted on nickel-chromium steels indicate expansions and contraction is related directly to temperature alterations. Summary shows results of subjecting metal to various conditions. (Abstract). Paper presented before Iron & Steel Inst.

STEEL, HIGH-SPEED

MANUFACTURE. Practical Notes on the Manufacture and Treatment of High-Speed Steel, H. K. Ogilvie. Iron & Coal Trades Rev., vol. 105, no. 2845, Sept. 8, 1922, no. 331-333. Deals chiefly with manufacture in basic-lined electric furnace. (Abridgment.) Paper read before Iron & Steel Inst. See also Engineer, vol. 134, no. 3481, Sept. 15, 1922, pp. 282-283.

STEEL MANUFACTURE

ELECTRIC FURNACES. Electric Steel Production of the World, Edwin F. Cone. Iron Age, vol. 110, no. 11, Sept. 14, 1922, pp. 653-654. Record of leading countries from 1913 to 1921. Post-war and present conditions. Pig iron from electric furnaces.

STEEL WORKS

England. The Devonshire Ironworks, Engineer, vol. 134, no. 3480, Sept. 8, 1922, p. 242, 3 figs., partly on p. 246. Consists in the main of up-to-date blast furnace plant, one of the largest coke-oven plants in United Kingdom, and extensive pipe foundries for manufacture of cast-iron pipe; also comprises large by-product recovery plant, and chemical plant for manufacture of sulphuric and nitric acids, and other chemicals.

Holland. Construction of the Royal Dutch Steel Works at Velsen, Holland (La construction des Aciéries royales néerlandaises à Velsen (Hollande). Génie Civil, vol. 81, no. 6, Aug. 5, 1922, pp. 138-139, 2 figs. Work in connection with providing access; construction of works themselves; buildings for personnel; etc.

STOKERS

Mechanical. Mechanical Stokers and Stoking, Walter N. Polaskov. Management Eng., vol. 2, no. 6, June 1922, pp. 325-330 and vol. 3, nos. 1, 2, 3 and 4, July, Aug., Sept. and Oct, 1922, pp. 29-36, 73-80, 171-179 and 233-241, 50 figs. June: Origin and development. July: Process of combustion. Aug.: Chain-grate stokers. Sept.: Overfeed stokers. Oct.: Underfeed stokers.

Underfeed. Detroit Edison Co. Has Superstoker, E. E. Dubry. Power, vol. 56, no. 14, Oct. 3, 1922, pp. 536-538, 5 figs. 13-retort underfeed stoker having total grate area of 470 sq. ft. replaces double stoker setting under Stirling type-W boiler of 23,654-sq. ft. effective heating surface, and makes possible big reduction in number of overhead bunkers and coal-conveying equipment.

STORAGE BATTERIES

Applications. The Application of the Electric Accumulator, H. Beckmann. Eng. Progress, vol. 3, no. 9, Sept. 1922, pp. 189-194, 16 figs. Notes on stationary batteries; storage-battery rail vehicles; coaches and locomotive; electric motor cars; battery boats.

STRESSES

Cylinder Walls. The Stress of a Thin Cylinder Wall Taking Deformation into Consideration (Die Beanspruchung einer dünnen Zylinderwand bei Berücksichtigung der Formänderung), Josef Krebitz. Eisenbau, vol. 13, nos. 6 and 7, June 20 and July 25, 1922, pp. 119-124 and 143-149, 6 figs. Investigation of deformation of cylinder wall which is free from bending stress.

SUBSTATIONS

Automatic. Features of St. Louis Automatic Substation, Walter H. Millan. Elec. World, vol. 80, no. 16, Oct. 14, 1922, pp. 817-820, 7 figs. Automatic reclosing outgoing feeders; motor-operated valve on cooling system of transformers and regulators; transformer core lifted on steel frame extending through roof.

SURVEYING

Boundary. Sources of Error Occurring in Boundary Surveys, C. V. Hodgson. Eng. News-Rec., vol. 89, no. 13, Sept. 28, 1922, pp. 517-518. Precise triangulation prerequisites to satisfactory boundary determination. Examples of station error in astronomic method.

SWITCHBOARDS

Installation Details. Installation Details of Switchboards and Control Pits, W. Frank Sutherland. Elec. World, vol. 80, no. 15, Oct. 7, 1922, pp. 763-767, 10 figs. Disadvantages of standard switchboard base; examples of sightly and convenient construction; details applicable to boards of various kinds.

T

TANKS

Concrete. Oil-Proof Treatment of Concrete Storage Tanks, Reginald Brown. Petroleum Times, vol. 8, no. 191, Sept. 2, 1922, p. 342. Results of author's experiments.

Industrial. Getting the Most out of Industrial Tanks, Charles L. Hubbard. Factory, vol. 29, no. 4, Oct. 1922, pp. 398-400 and 457-458, 6 figs. Suggestions for selection of right tank.

TERMINALS, MARINE

Freight. Inland Waterways Freight Terminals, H. McL. Harding. World Ports, vol. 10, no. 10, Aug. 1922, pp. 72-77, 2 figs. It is claimed that one direct movement with one operation of freight only, between vessel and shore, gives greatest speed of transference and economy of operation; fewest movable mechanical parts reduce maintenance expense and assist continuous operation.

TESTING MACHINES

Railway Material. Deflection Testing of Locomotive Axles. Engineer, vol. 134, no. 3480, Sept. 8, 1922, pp. 279-280, 3 figs. Describes universal 100-ton testing machine, constructed by A. J. Amsler & Co., Schaffhausen, Switzerland, for performing acceptance tests on railway material, such as hooks, chains, axles, couplings, etc.

THERMODYNAMICS

Heterogeneous Equilibria, Application to. The Application of Thermodynamics to Heterogeneous Equilibria, George W. Morey. Franklin Inst. Jl., vol. 194, no. 4, Oct. 1922, pp. 425-484, 11 figs. By detailed application of described equation (equation 97) problems of heterogeneous equilibria may be solved completely if entropy and volume changes are known in their entirety, and it is possible to predict behavior of system when subjected to changes in pressure, temperature, and composition.

Molecular. Molecular Thermodynamics, Bernard A. M. Cavanagh. Lond., Edinburgh, & Dublin Philosophical Mag. & Jl., of Sci., vol. 44, no. 261, Sept. 1922, pp. 610-640. Analysis of problem of "solvation of solutes" to which is attached discussion of results.

TIDAL POWER

Utilization. Theory of River Tides and Their Utilization (Sur la théorie des marées fluviales et ses applications), Charles Ribiere. Annales des Ponts et Chaussées, vol. 1, no. 3, May-June 1922, pp. 266-276. Mathematical investigation showing that substantial modifications are necessary in current formulas used.

Utilization of Tidal Power (Sur l'utilisation de l'énergie des marées), A. Defour. Revue Générale de l'Electricité, vol. 11, no. 9, Mar. 1, 1922, pp. 313-322, 8 figs. Discusses the Maire, Claude, Etat and Defour cycles and compares their efficiency.

TIRES, RUBBER

Rolling Resistance. Rolling Resistance of Rubber Tires, E. H. Lockwood. India Rubber World, vol. 67, no. 1, Oct. 1, 1922, pp. 13-15, 4 figs. Notes on rear-wheel dynamometer; measuring tire resistance; solid-tire tests; cord and fabric-tire tests; loss of power in tires.

TOOL STEEL

Graphitization. Graphitization in a Carbon Tool Steel, Henry S. Rawdon and Samuel Epstein. Chem. & Met. Eng., vol. 27, no. 13, Sept. 27, 1922, pp. 650-651, 8 figs. Examination of type of black fracture occasionally occurring in annealed carbon-tool-steel bars.

Machinability. The Effect of Structure upon the Machining of Tool Steel, J. V. Emmons. Am. Soc. for Steel Treating, Trans., vol. 2, no. 12, Sept. 1922, pp. 1100-1110 and 1212, 20 figs. Discusses effect of hardness and structure of tool steel upon its machinability. Machining operations considered are turning, milling, drilling, reaming, thread cutting, swaging, wire drawing, punching and shearing. Conclusions as to most favourable structures for various machining processes.

TRACTORS

Caterpillar. Making Tracks for Caterpillars, Howard L. McLean. West. Machy. World, vol. 13, no. 9, Sept. 1922, pp. 311-312, 5 figs. Notes on methods and machines used in Holt factory at Stockton, Cal., for machining and assembling flexible steel tracks.

Road-Building Machinery. Internal-Combustion-Engine Power for Road-Grading Machinery, C. O. Woid. Soc. Automotive Engrs. Jl., vol. 11, no. 4, Oct. 1922, pp. 323-326 and (discussion) 326-327, 4 figs. Deals with large versus small tractors and most suitable type of tractors; engine requirements; use of multiple-unit road machinery behind one power unit; combination tractor and grader units; general utilization of power units; power requirements of concrete-road construction.

Suction-Gas. The Suction Gas Tractor. Engineer, vol. 134, no. 3482, Sept. 22, 1922, p. 306. Considerations relating to use of suction gas producers on tractors and their design and working.

TRANSFORMERS

Auto-Transformers. Auto Transformers, Frank C. Vogan. Power Plant Eng., vol. 26, nos. 14, 15 and 16, July 15, Aug. 1 and 15, 1922, pp. 710-712, 755-756 and 805-808, 4 figs. July 15: Theory of operation, advantages over 2-winding type of transformers. Aug. 1: Determining their rating and factors governing their selection. Aug. 15: Examples showing their application on lighting and power circuits.

TUBING

Steel. Corrugated Steel Tubing for High-Pressure Liquids (Tubes ondulés en acier pour fluides à haute pression), R. Joessel. Génie Civil, vol. 81, no. 6, Aug. 5, 1922, pp. 130-133, 9 figs. Construction, application and advantages; gives greater elasticity lengthwise; has greater resistance to pressures and is easily adjustable to any profile.

TUNGSTEN

Preparation. The Story of Tungsten, W. C. Balke. West. Soc. Engrs. Jl., vol. 27, no. 8, Aug. 1922, pp. 223-232, 8 figs. Notes on place of tungsten among elements and nature of element; and description of various steps through which it passes to finished pure tungsten product; properties and uses.

TURBO-GENERATORS

Protective Apparatus. Protective Apparatus for Turbo-Generators, J. A. Kusser. Instn. Elec. Engrs. Jl., vol. 60, no. 311, July 1922, pp. 761-776 and (discussion) 777-790, 25 figs. Deals with causes of breakdowns in turbo-alternators, particularly in stator winding and discusses means for limiting damage in case breakdowns do occur. Proposes new system of protection which has advantage of protection against faults between turns.

U

UNEMPLOYMENT

Insurance. Unemployment Insurance in Theory and Practice. Nat. Indus. Conference Board, Research Report, no. 51, June 1922, 127 pp. Outline of theory and main questions involved in such insurance; analysis of development of and practical experience with this theory, principally in Europe; survey of theory and problems as related to situation in United States.

Prevention. Prevention of Unemployment, U. S. Bur. of Labor Statistics Bul., no. 311, Aug. 1922, pp. 60-78. Contains following articles: Measurement of Unemployment—The Heed for Additional Information, F. S. Deibler. Contribution of Vocational Guidance to the Prevention of Unemployment, Helen T. Woolley. Reviving Private Industry through Public Works, Otto T. Mallery.

V

VARNISHES

Electrical Conductivity. Changes in the Electrical Conductivity of Varnishes During Drying, H. C. P. Weber. Am. Electrochem. Soc. advance paper, no. 11, for meeting Sept. 21-23, 1922, pp. 89-96, 4 figs. Certain types of varnishes are capable of developing substances of low electrical resistance during drying and oxidation; these substances are acidic, slightly volatile and may be shifted about and accumulated by temperature differences.

VENTILATION

Air-Duct Calculation. How to Figure Rectangular Air Duct Sizes Quickly, W. L. Durand. Am. Soc. Heating & Vent. Engrs., Jl., vol. 28, no. 7, Oct. 1922, pp. 719-721, 1 fig. Presents table prepared by author that will give correct-size rectangular air duct with minimum of effort which means materially simplifying calculations.

Automatic, Ventilators. Comparative Tests of Automatic Ventilators, J. P. Calderwood, A. J. Mack and C. J. Bradley. Am. Soc. Heating & Vent. Engrs. Jl., vol. 28, no. 5, July 1922, pp. 505-513, 6 figs. Tests conducted in engineering experiment station of Kansas State Agricultural College to determine efficiency of various types.

W

WAGES

Incentive Systems. Effect of Labor Setting on Labor Costs, William O. Lichtner. Indus. Management, vol. 64, no. 3, Sept. 1922, pp. 169-172, It is claimed that managers have taken incentive out of wage-inventive systems by unintelligent rate cutting.

Piece-Rate Methods. Putting Production Incentive into Pay Envelopes, Samuel Theaker. Indus. Management, vol. 64, no. 4, Oct. 1922, pp. 216-220, 3 figs. Explains how good points of piecework can be utilized while removing at the same time the disfavour with which it is regarded.

WASTE HEAT

Utilization. Blast Furnace Waste Heat Utilized, Hubert Hermanns. Blast Furnace & Steel Plant, vol. 10, no. 10, Oct. 1922, pp. 531-534, 9 figs. Points out that by employing waste-heat utilizers in conjunction with engines large part of waste heat may be recovered. Account of German experiences.

WASTE PREVENTION

Industrial. A Further Consideration of the Report of the Committee on Elimination of Waste in Industry, Thomas W. Mitchell. Taylor Soc. Bul., vol. 7, no. 5, Oct. 1922, pp. 198-204.

WATER

Specific Heat. The Ratio of the Calorie at 73° to That at 20°, Arnold Romberg. Am. Acad. Arts & Sci. Proc., vol. 57, no. 15, June 1922, pp. 377-378, 10 figs. Describes experiment designed as crucial test of correctness of temperature-variation curve of specific heat of water.

WATER POWER

St. Lawrence Region. Water Power Situation in the St. Lawrence Region, J. T. Johnston. Can. Engr., vol. 43, no. 12, Sept. 19, 1922, pp. 359-361, 2 figs. Relation to St. Lawrence Waterway development; 6,077,427 undeveloped horsepower within 300 miles of Long Sault exclusive of undeveloped St. Lawrence Power; probable demand for power.

Snake River. Snake River as a Source of Power, W. G. Hoyt. Elec. World, vol. 80, no. 16, Oct. 14, 1922, pp. 811-813, 3 figs. Undeveloped power sites total 1,510,000 hp., with existing flow available for 90 per cent of time.

Tastes and Odors. Modern Practce in the Remoual of Taste and Odor, Norman J. Howard. Am. Water Works Assn. Jl., vol. 9, no. 5, Sept. 1922, pp. 766-792. Tastes from microscopic organism; taste and other following chlorination.

WATER SUPPLY

Panama Canal. Water Supply of the Panama Canal, R. Z. Kirkpatrick. Pacific Mar. Rev., vol. 19, no. 10, Oct. 1922, pp. 551-554, 4 figs. Resumé of past, present and future situation.

WATER TREATMENT

Chlorination. How Should Water Be Sterilized? Contract Rec., vol. 36, no. 39, Sept. 27, 1922, pp. 848-950. Report on water supply of London, Eng., contains explanation of methods of using chlorine in its various forms for water sterilization.

WEIRS

Herschel Type. An Investigation of the Herschel Type of Weir, Richard H. Morris and Albert J. R. Houston. Mech. Eng., vol. 44, no. 10, Oct. 1922, pp. 651-654, 8 figs. Results of tests made to determine effect of various modifications in construction on action of improved type of weir designed by Clemens Herschel for gaging in open channels.

WELDING

Electric-Railway Practice. Welding as Practised by Electric Railways. Elec. Ry. Jl., vol. 60, no. 15, Oct. 7, 1922, pp. 567-568. Symposium of papers forming basis of discussion at joint meeting of Am. Welding Soc. and Am. Elec. Ry. Eng. Assn. Fields of several varieties of welding were outlined.

Tube. Contraction in Tube Welding, Marcel Piette. Acetylene Jl., vol. 24, no. 3, Sept. 1922, pp. 120-121, 5 figs. Distortion can be avoided by expanding pieces in opposite sense before welding. Translated from Revue de la Soudure Autogène, with additions.

See also Electric Welding; Oxy-Acetylene Welding.

WIRE MANUFACTURE

Forming. Wire Forming Machy. (Lond.), vol. 20, nos. 516 and 521, Aug. 17 and Sept. 21, 1922, pp. 597-600 and 756-760, 18 figs. Methods used in manufacture of wire goods and general principles applied in design of typical wire-forming machine. See also Machy. (N.Y.), vol. 28, no. 12, Aug. 1922, pp. 239-942 and vol. 29, no. 1, Sept. 1922, pp. 26-30, 17 figs.

WOOD

Heating Value of American Woods. The Calorific Value of American Woods, S. W. Parr and C. N. Davidson. Jl. Indus. & Eng. Chem., vol. 14, no. 10, Oct. 1922, pp. 935-936, 3 figs. Results of experiments to determine "end point."

Testing Machine. Amsler Machine for Static and Dynamic Testing of Wood (Machine Amsler pour les essais statiques et dynamiques des bois). Bul. Technique de la Suisse Romande, vol. 48, no. 17, Aug. 19, 1922, pp. 197-201, 9 figs. Built by A. J. Amsler & Co. at Schaffhausen for bending, compression, impact and other tests; construction and operation.

Z

ZINC

Electrolytic Plant. Electrolytic Zinc Works in Tasmania. Engineer, vol. 134, no. 3482, Sept. 22, 1922, pp. 289-290, 4 figs., partly on p. 300. Details of plant producing 30,000 lb. of zinc per 24 hr.

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Official Report of a Test by McGill University

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The test was made to determine if Interlocking Tile could be safely loaded to the Toronto Building Code Limit of four and one-half tons per square foot.

The results of the tests were so good that a building might be designed in which the walls would carry a load of six tons per square foot.

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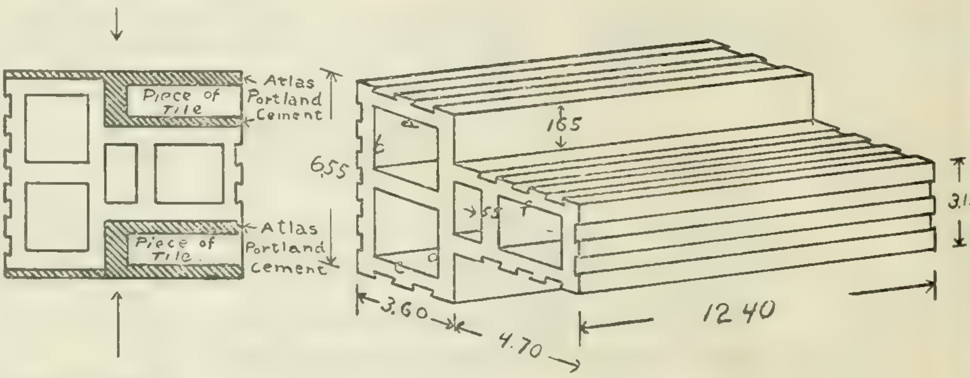

Method of Testing

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Montreal, January 28th 1921

ABSORPTION TEST

Sample	Dry Weight Lbs.	Weight After Immersion in Water		Increase in Weight, Lbs.	Increase Per Cent
Light	15.317	24 hrs.	17.304	1.987	12.9
burned		48 hrs.	17.336	2.019	13.1
Medium	15.448	24 hrs.	16.183	.735	4.7
burned		48 hrs.	16.225		5.0

CRUSHING TEST

The loading faces were levelled up with Portland Cement and after resting for seven days, the whole of each loading face was prepared with plaster of Paris, giving an even distribution of load.

The net areas of the vertical walls sustaining the loads were determined by measuring the thicknesses from the bottoms of the groves.

	Light Burned	Medium Burned
Length of shells and webs, inches..................	12.2	11.73
Net areas of vertical wall and webs.................	24.91	23.94
Maximum loads sustained, lbs......................	85,700	155,900
Maximum loads in lbs. per sq. in. of vertical section	3,490	6,500

(Signed) H. M. Mackay, M.E.I.C.
Prof. of Civil Eng.

(Signed) S. D. McNab, A.M.E.I.C.
Supt. of Test Lab.

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